X. Tumwater and Natapoc MLSA, Deadhorse LSR

A. General Description of LSR

This portion of the document describes the vegetation, wildlife, aquatic resources and human uses associated with this LSR.

1. Vegetation

This section describes the current condition of vegetation groups within the Deadhorse LSR and the Natapoc/Tumwater MLSAs. Data was derived from aerial photo interpetation (Appendix 3). It should be noted that site-specific information regarding vegetation structure and distribution will need to be updated, as restoration projects are initiated. The idea would be to use the vegetation layer derived for this analysis as a starting point only.

The initial assessment for the Tumwater MLSA and Deadhorse LSR provides additional information (on file at the Leavenworth RD).

a) Dry Forest Group and Grassland/Shrubland

Sixty-five percent (11,994 acres) of the Deadhorse LSR consists of the dry forest group (Fig. ?). Within this group, 53 percent (6,377 acres) of the Deadhorse LSR is mapped as high density and 36 percent (4,384 acres) is mapped as low density (Appendix 4). Within the Tumwater MLSA, 52 percent (2,134 acres) is mapped as dry forest and 40 percent (843 acres) of this area are created openings caused by the Hatchery Creek Fire (Appendix 5). The actual amount of created openings may be more since the mapping occured immediately following the fire and overstory mortality was not likely realized. Sixty-six percent (706 acres) of the Natapoc MLSA consists of the dry forest group (Fig ?). Of this acreage, 71 percent (500 acres) is mapped high density (Appendix 5).

Within this forest group, the ponderosa pine series is limited within the Deadhorse LSR and Tumwater/Natapoc MLSAs. In some locations, ponderosa pine exists as the sole overstory dominate, but more often is co-dominant with Douglas-fir. Shrub composition in the understory is dominated by *Purshia tridentata* and *Holodiscus discolor.* Grasses include *Agropyron spicatum, Calamagrostis rubescens,* and forbs present include *Achillea millefolium, Lupinus serecius, Balsamorhiza sagitata,* and *Lomatium* spp.

A small amount (393 acres) of grassland or shrubland occurs with the Deadhorse LSR (Appendix 4). Basically, no acres were mapped in the Tumwater or Natapoc MLSAs. Grassland or shrubland vegetation is similar to *P. tridentata* or *Agropyron spicatum* habitat types described by Daubenmire (1988).

b) Mesic Forest Sites (Embedded within the Dry Forest Group)

Mesic sites constitute 13 percent (2,446 acres) of the Deadhorse LSR and nearly 80 percent of mesic sites mapped were layered/mature (Appendix 4). Twenty-two percent (232 acres) of the Deadhorse MLSA and only one percent of the Tumwater MLSA were mapped as mesic sites.

In general, mesic sites occur on steep (>40 percent slopes), northerly aspects, riparian areas, or moist benches within the dry forest group (see Vegetative Landscape section, Chapter II). It will

be important for these sites to be identified through restoration projects since suitable spotted owl habitat may need to be promoted or maintained within a 1.8-mile radius of spotted owl circles on mesic sites. Mesic sites outside of these circles (see wildlife section) would be managed similarly to dry forest sites, but different species compositions and structures would direct specific management strategies.

Mesic sites are typically within the Douglas-fir series and include the more moist plant associations. Ponderosa pine may be present, but only as remnants from early seral establishment. The understory tends to be more lush, often with a higher shrub component than in the more dry plant associations within the Douglas-fir and ponderosa series. Understory species include *Symphoricarpos albus, Arctostaphylos uva-ursi, Spiraea betulifolia, Pachistima myrsinites, Carex concinnoides, Festuca occidentalis, Carex geyeri,* and *Calamagrostis rubescens.*

c) Moist Grand Fir Group

A small portion of the Deadhorse LSR and Natapoc/Tumwater MLSAs consists of the moist grand fir group. Thirteen percent (2,391 acres) of the Deadhorse LSR consists of this vegetation group. Of this acreage, 64 percent (1,521 acres) were mapped as layered mature (Appendix 4). Eleven percent (464 acres) of the Tumwater MLSA and nine percent (96 acres) of Natapoc MLSA consist of the moist grand fir group. Discussing the percentages of various vegetative structures is rather meaningless because of the small acreage present. Within the Deadhorse LSR and Natapoc/Tumwater MLSAs, moist grand fir is restricted to ridge tops and north aspects.

Understory composition is graminoid and forb dominated with such species as *Calamagrostis rubescens, Spiraea betulifolia, Rosa gymnocarpium, Linnaea borealis,* and *Chimaphila umbellata.*

d) Wet Forest Group

This forest group is not present in the Deadhorse LSR and Tumwater/Natapoc MLSAs.

e) Subalpine Fir Series

Nine percent (373 acres) of the Tumwater MLSA consists of the subalpine fir series (Appendix 4). Nearly all of this mapping unit occur as created openings caused by the Hatchery Creek Fire. This series is restricted to the highest elevations on Icicle Ridge.

Subalpine fir is the most widespread species within the overstory. Common seral dominants include lodgepole pine and Engelmann spruce. Information is lacking regarding understory species composition.

f) Whitebark Pine/Subalpine Larch Group and High Elevation Nonforest Types

This vegetation group does not exist within the Deadhorse LSR or the Tumwater and Natapoc MLSAs.

g) Non-Forest Vegetation

Eight percent (1,468 acres) of the Deadhorse LSR was mapped as non-forest vegetation (Appendix 4) which includes 393 acres of grassland/shrubland (27 percent) discussed above. Twenty-one percent (305 acres) of this type is mapped agricultural or residental and 12 percent (170 acres) is mapped as water because of the Wenatchee River. Scree slopes account for 14 percent (213 acres) and six percent (86 acres) of this mapping unit is cliff. Brushfields (206

acres, 14 percent) and deciduous forest (62 acres, 4 percent) were mapped near the Wenatchee River and north within the LSR. Few meadows occur within the Deadhorse LSR.

Only three percent (35 acres) of non-forest vegetation, nearly all of which was agricultural or residential, was identified within the Natapoc MLSA (Appendix 5). One quarter (1,029 acres), however, of the Tumwater MLSA was mapped as this type (Appendix 5). Again, the Wenatchee River accounts for a portion of this acreage (115 acres, 11 percent). Cliffs make up the majority of this type (673 acres, 65 percent) and brushfield within steep, rocky chutes also are prevalent

h) Species with Special Status

Within the Deadhorse LSR and the Natapoc/Tumwater MLSAs, there is potential habitat for a number of special status species, but few surveys have been carried out to determine presence or absence. Portions of the Tumwater and Natapoc MLSAs have been surveyed in conjunction with timber or salvage sale projects. Additional surveys should be carried out in conjunction with restoration projects, as well as surveys independent of other activities. It is important that species ranges are known so that better estimates of species viability can be assessed. In addition, little is known about most special status species habitat and biological requirements, and inventories provide a first and necessary step in obtaining this information.

There are several known Forest Service sensitive vascular plant and survey and manage species (see Late-Successional Associated Plant Species, Chapter IV) within the Deadhorse LSR and the Natapoc/Tumwater MLSAs (Appendix 6). In addition, a few species are suspected to occur within the LSR or MLSAs Sensitive plant species within the Deadhorse LSR include *Cypripedium fasciculatum, Hackelia arida* var. *disjuncta,* and *Orobanche pinorum.* Known survey manage species include *Cantharellus cibarius, C. subalbidus, Gyromitra montana,* and *Cyphelium inquinans.* Within the Tumwater MLSA, sensitive plant species include *C. fasciculatum, Hackelia venusta, Iliamna longisepala, Silene seelyi,* and *Saxifragopsis fragarioides*. There are no known survey and manage species within this MLSA. Sensitive plant species within the Natapoc MLSA include *Botrychium montanum, C. fasciculatum,* and *O. pinorum.* Survey and manage species include *C. subalbidus, G. montana, Nephroma resupinatum*, and several vascular plants. Their state or federal status is provided in Appendix 6.

Cypripedium fasciculatum has been the focus of a number of research and monitoring projects over the past four years on the Leavenworth Ranger District. Project include pollination ecology, seed dispersal, habitat characteristics, seed germination, electrophoresis, and fire ecology.

Habitat information regarding *Botrychium* species has been collected and summarized in a number of publications, as well as local information specific to habitats on the Lake Wenatchee Ranger District.

Most of what is known relative to habitat requirements of *Iliamna longisepala* has been made through casual observations. It has been observed (Harrod, personal observation) that this species occurs in disturbed areas including burns, roads, and skid trails. This observation suggests that *I. longisepala* is an early successional species and appears to require open habitats for seed germination, seedling establishment, avoidance of interspecific competition, and/or some other aspect of its life history.

A recent study by Kuhlmann and Harrod (unpubl. report) reports the results of one year of post-fire monitoring on *I. longisepala.* This study found that post-burn populations are younger than unburned populations based an analysis of morphological characters. Greater percent vegetative and lower percent reproductive plants were also present in burned sites. These results suggest

that *I. longisepala*, in fact, may respond to fire similar to that of *I. rivularis* which has fire-stimulated germination (Crane and Fischer 1986).

Orobanche pinorum is an achlorophyllus plant and obligate root parasite of *Holodiscus discolor*. Aerial stems are annual, developing from a haustorial turbercle. From each stem, 50-150 flowers are produced in late June or early July. The species is facultatively autogamous and it apparently only reproduces by seed (Ellis et al. 1994).

Orobanche pinorum is often found in *Pseudotsuga menziesii* dry forest associations with incomplete upper canopies between 460 and 1220 meters in elevation (Harrod et al. in press). These sites have scattered herb and low shrub understories, and a tall shrub layer dominated by its host, *H. discolor*.

Silene seelyi occurs in rock crevices, typically on north or west aspects. Little is known about the biological or ecological requirements of this species. One study found that the species does tolerate fire, but whether it responds by resprouting or colonizing is unknown (Harrod et al. in press).

i) Noxious Weeds

The Deadhorse LSR and Natapoc/Tumwater MLSAs have been partially surveyed for noxious weed species in 1992. Species known to occur include *Centaurea diffusa, Linaria dalmatica, Cytisus scoparius, Chrysanthemum luecanthemum,* and *C. maculosa.* Extent of weeds can be found in GIS on the Leavenworth or Lake Wenatchee Ranger Districts. Surveys for species presence and extent should be completed in order to develop a noxious management plan for these LSR/MLSAs (refer to Harrod 1994).

2. Late Successional Associated Wildlife Species

a) Introduction

In this chapter, information is presented about wildlife species that are associated with the late-successional habitats that are either present or would be managed for in the Natapoc MLSA, Tumwater MLSA and Deadhorse LSR. A total of 80 species have been identified as being associated with these kinds of forest conditions and are present, unknown or suspected to occur within the MLSAs. The list of these species can be found in Appendix 27.

In addition to consideration for the groups of species associated with the various kinds of late-successional forests, individual species assessments were also conducted. These assessments were completed for all threatened, endangered, sensitive, species of concern (USFWS), management indicator, protection and buffer, and survey and manage species. Collectively this group of species is referred to as species of special status. What information is available about the status of these species within the Natapoc MLSA, Tumwater MLSA and Deadhorse LSR is summarized in this chapter. However, relatively little is known about a number of them.

Inventories or surveys have been conducted for only a few of the wildlife as shown in Appendix 27. The most extensive of these were for mule deer, elk, bald eagle and spotted owls. Northern spotted owl inventories have been conducted over about 50% of the suitable habitat within the Natapoc MLSA, and 80% of the suitable habitat within the Tumwater MLSA and Deadhorse LSR.

b) Late Successional Species By Habitat Type

(1) Dry Forests

About 706 acres (66%) of the Natapoc MLSA, 2,134 acres (52 %) of the Tumwater MLSA and 11,994 acres (65%) of the Deadhorse LSR are composed of the dry forest vegetation group. Fire climax ponderosa pine forests historically dominated these areas and 49 wildlife species are associated with these forests.

Currently, 500 acres (71%) of the dry forest in the Natapoc MLSA, 696 acres (33 %) in the Tumwater MLSA and 6,377 acres (53%) in the Deadhorse LSR are in a successionally advanced condition. About 183 acres (26%) in the Natapoc MLSA, 595 (28 %) of the Tumwater MLSA and 4,384 acres (37%) of the Deadhorse LSR are in a low density condition and could be fire-climax.

Some species that are associated with the late successional or fire-climax conditions of these forests and that have special management status include: tailed frog, larch mountain salamander, northern goshawk, bald eagle, flammulated owl, pileated woodpecker, hairy woodpecker, white-headed woodpecker, black-backed woodpecker, Williamson's sapsucker, northern flicker, chestnut backed chickadee, pygmy nuthatch, elk, long-legged myotis, long-eared myotis, silver haired bat, fringed myotis, western big-eared bat, pallid bat, marten, and fisher.

Historically, only a minor portion of these areas provided the structures that are associated with suitable spotted owl habitat (Thomas et al. 1990, Buchanan et al. 1995). However, fire exclusion has allowed successional advancement for suitable spotted owl habitat to develop in some areas (Agee and Edmunds 1992, Buchanan et al. 1995). These areas are now being used by spotted owls, however the risk of large scale disturbances causing large scale habitat loss is of major concern (Agee and Edmunds 1992, Buchanan et al. 1995, Gaines et al. in press). Eight spotted owl activity centers occur in the Dry Forests within the Deadhorse LSR and one occurs in the Tumwater MLSA.

(2) Mesic Sites Within the Dry Forest

The mesic forest group covered about 232 acres (22%) of the Natapoc MLSA, 26 acres (1 %) of the Tumwater MLSA and 2,466 acres (13%) within the Deadhorse LSR. Mesic sites within the dry forests provide important wildlife habitat and add diversity across the landscape.

Historically, fire occurred less frequently at these sites (refer to the Disturbance Chapter in the Forest-wide Assessment) allowing for succession that resulted in more complex forest structure such as a higher canopy closure, multilayering, snags and down logs. These forests occurred in a variety of successional stages across the landscape. The late-successional conditions of these Mesic Forests provide habitat for about 66 wildlife species. The high potential for future fires presents a concern about the sustainability of these forests.

Currently, 119 acres (51%) of the mesic sites in the Natapoc MLSA, 26 acres (100 %) of the Tumwater MLSA and 1,945 acres (79%) in the Deadhorse LSR are in a late-successional condition. In the absence of any major disturbances the amount of late-successional habitat within the mesic forests in 50 years would be about 232 acres (100) in the Natapoc MLSA and 2,276 acres (92%) in the Deadhorse LSR. In 100 years about 2,466 acres (100%) of the Deadhorse LSR would be in a late-successional condition.

Wildlife species that occur in these habitats and are of special management status include: tailed frog, Cascades frog, larch mountain salamander, northern goshawk, bald eagle, northern spotted owl, great gray owl, flammulated owl, pileated woodpecker, downy woodpecker, hairy woodpecker, white-headed woodpecker, black-backed woodpecker, three-toed woodpecker, red-breasted sapsucker, Williamson's sapsucker, northern flicker, little willow flycatcher, olive-sided flycatcher, chestnut-backed chickadee, pygmy nuthatch, elk, long-legged myotis, long-eared

myotis, fringed myotis, Yuma myotis, western big-eared bat, silverhaired bat, pallid bat, marten, and fisher.

This forested vegetation group is capable of providing habitat structure that typically composes spotted owl nesting, roosting, foraging and dispersal habitat, while remaining within the historic range of variability. The spotted owl activity centers that occur within the dry forests include some mesic sites.

(3) Moist Grand Fir Group

The Moist Grand Fir group covers about 96 acres (9%) of the Natapoc MLSA, 464 acres (11 %) of the Tumwater MLSA and about 2,391 (13%) of the Deadhorse LSR. Historically, fire occurred less frequently than in the Dry and Mesic vegetation groups (refer to the Disturbance Chapter in the Forest-wide Assessment), allowing successional advancement and complex habitat structure such as high crown closure, multilayering, and many snags and down logs. These conditions provide habitat for a wide array of wildlife species, including 73 species within the Natapoc MLSA, Tumwater MLSA and Deadhorse LSR.

Currently, about 51 acres (82%) of the Moist Grand Fir group in the Natapoc MLSA 332 acres (72%) of the Tumwater MLSA and 1,521 acres (64%) is in a late-successional condition. In the absence of any major disturbance, it is expected that in 50 years 96 acres (100%) in the Natapoc MLSA, 358 acres (77 %) of the Tumwater MLSA and 1,783 acres (75%) in the Deadhorse LSR would be in a late-successional condition. In 100 years about 464 acres (100 %) in the Tumwater MLSA and 2,391 acres (100%) in the Deadhorse LSR would be late-successional.

Wildlife species associated with the late-successional conditions of this vegetation group and of special status include the northern goshawk, bald eagle, northern spotted owl, great gray owl, flammulated owl, pileated woodpecker, downy woodpecker, hairy woodpecker, white-headed woodpecker, black-backed woodpecker, three-toed woodpecker, red-breasted sapsucker, Williamson's sapsucker, northern flicker, little willow flycatcher, olive-sided flycatcher, red-breasted nuthatch, pygmy nuthatch, tailed frog, spotted frog, Cascades frog, larch mountain salamander, warty jumping slug, blue-gray tail-dropper, papillose tail-dropper, Columbia pebblesnail, long-legged myotis, long-eared myotis, fringed myotis, Yuma myotis, silver-haired bat, western big-eared bat, pallid bat, elk, lynx, marten and fisher.

The Moist Grand Fir vegetation group is capable of providing structures that compose suitable spotted owl nesting, roosting, and foraging habitat while remaining within the range of historic variability. One known spotted owl activity center is located within this vegetation group.

c) Species Specific Information

The information presented in this section provides an overview of what is known about the species identified in Appendix 27 as species of special status. Information is provided on a species by species basis whenever it is available.

(1) Endangered Or Threatened Wildlife Species

There are five wildlife species that are federally listed as Threatened or Endangered and could occur within the Natapoc MLSA and Deadhorse LSR . These include the bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), northern spotted owl (*Strix occidentalis caurina*), grizzly bear (*Ursus arctos*), and gray wolf (*Canis lupus*). In addition, a critical habitat unit (WA-9) overlays a portion of both the Natapoc MLSA, Tumwater MLSA and Deadhorse LSR.

The bald eagle is known to occur in all areas and surveys have been completed over about 50% of the Deadhorse LSR, 100 % of the Tumwater MLSA and none of the Natapoc MLSA. It is unknown if the peregrine falcon occurs in all areas. Fifty percent of habitat has been surveyed in the Tumwater MLSA, none in Natapoc MLSA or Deadhorse LSR.

(a) Northern Spotted Owls

A total of 7 spotted owl activity centers occur within the Deadhorse LSR, an historic single spotted owl site (SO762) is within the LSR, and an additional activity center (SO721) is adjacent to the LSR. The Tumwater MLSA has one spotted owl activity center (SO722). There are no spotted owl activity centers in the Natapoc MLSA, there is one historic single (SO640). These LSR/MLSAs were established to compensate for fragmented habitat, intermingled with private land, and is important for range-wide distribution of owl habitat, as it is on the northeastern edge of the range.

Spotted owl habitat for nesting/roosting and foraging within the three LSR/MLSAs totals 7,816 acres (33% of the combined LSR/MLSAs). Deadhorse has 6,692 acres (37% of the LSR), Tumwater has 662 acres (16% of the MLSA), and Natapoc has 462 acres (43% of the MLSA) of spotted owl habitat. Dispersal habitat (which may grow into foraging, roosting and nesting), covers 10,021 acres (43%) of the combined LSR/MLSAs. The 1994 Hatchery Creek fire burned portions of the Deadhorse LSR and the Tumwater MLSA, affecting 3 pairs of owls.

There is potential (see appendix 13 LSR/MLSA Suitable Spotted Owl Habitat Acreage's) for a total of 13,060 acres (56% of the combined LSR/MLSAs) to become suitable spotted owl habitat, in the three LSR/MLSAs. Deadhorse could reach 11,044 acres (60%), Tumwater 1,188 acres (29%), and Natapoc 828 acres (77%). However, only 3,378 acres (14%) of the three LSR/MLSAs will be sustainable spotted owl habitat as moist forest groups (see Vegetation appendix 4 & 5). Within the Deadhorse LSR 80% of the spotted owl habitat has been surveyed for spotted owls. Spotted owl surveys have covered 80% of the Tumwater MLSA and 50% of the Natapoc MLSA.

The estimated amount of habitat within a 1.8 mile radius of the 8 activity centers is shown in Table ?_. All spotted owl home ranges are below threshold acres. There is one spotted owl site (SO703) that has more than 2,663 acres, but has less than 500 acre core within 0.7 miles radius. This habitat should be field verified and sites monitored. Portions of the Deadhorse LSR burned in 1994, and effected 2 owl sites. The Tumwater MLSA spotted owl site SO722 is excessively low due to the 1993 and 1994 fires. There are currently 926 acres within 1.8 miles radius, this site needs to be monitored. Within the Deadhorse LSR, Tumwater and Natapoc MLSAs, all spotted owl sites should be monitored and spotted owl habitat should be verified.

Table X-1, Spotted Owl Information for Deadhorse LSR, Tumwater MLSA and Natapoc MLSA

Spotted Owl Deadhorse	Repro Status[3]	Owner ship[4]	Dry or Wetter Owl[5]	Threshold[6]	Critical Habitat Unit (CHU)	Forest Interior?[8]	Suitable Spotted Owl Habitat	Total Dispersal Habitat
SO703	PY	FS	Wetter	Below Threshold	WA-9	None	**2,724**	**1,196**
SO715	PY	FS	Dry	Below Threshold	WA-9		**2,627**	**1,299**

Spotted Owl Deadhorse	Repro Status[3]	Owner ship[4]	Dry or Wetter Owl[5]	Threshold[6]	Critical Habitat Unit (CHU)	Forest Interior?[8]	Suitable Spotted Owl Habitat	Total Dispersal Habitat
SO720 (Burned)	RS	FS	Dry	Below Threshold	WA-9	Near	**1,542**	**2,085**
***SO721** (Burned)	PY	FS	Dry	Below Threshold		Near	**1,024**	**2,046**
SO725	PY	FS	Dry	Below Threshold	WA-9	Near	**1,894**	**2,192**
SO726	PY	FS	Dry	Below Threshold	WA-9		**2,538**	**1,644**
SO727	P	FS	Dry	Below Threshold	WA-9		**2,480**	**1,749**
SO744	P	FS	Dry	Below Threshold	WA-9	Near	**1,801**	**1,939**
Historic s.owls								
SO762	RS	PVT	Dry	Below Threshold	WA-9	Near	**2,763**	**1,389**
Natapoc	**Status[3]**	**Owner ship[4]**	**Dry or Wetter Owl[5]**	**Threshold[6]**	**Critical Habitat Unit (CHU)**	**Forest Interior?[8]**	**Suitable Spotted Owl Habitat**	**Total Dispersal Habitat**
Historic s.owls								
SO640	HS	FS	dry	n/a	none	Inside	--	--
Tum-water	**Status[3]**	**Owner ship[4]**	**Dry or Wetter Owl[5]**	**Threshold[6]**	**Critical Habitat Unit (CHU)**	**Forest Interior?[8]**	**Suitable Spotted Owl Habitat**	**Total Dispersal Habitat**
SO722 (Burned)	PY	FS	Dry	Below Threshold	WA-9		**926**	**1,146**

[1] Activity Center is Near the LSR or MLSA, but not inside the LSR or MLSA **map boundary** (< 1/4 mile).

[3] RS = Residential Single; P = Pair; PY = Pair with Young, HS = Historic Single. Site based on **highest Reproductive occupancy**.

[4] FS = Forest Service; PVT = Private Ownership (**ownership** at activity center).

[5] If the majority of suitable spotted owl habitat in **0.7 mile circle** is dry or mesic forest groups, then it is a "dry" spotted owl. If the majority is wetter forest groups, then it is a "wetter" spotted owl..

[6] **Below Threshold**: < 2,663 total suitable spotted owl habitat acres in 1.8 mile circle **OR** < 500 total suitable spotted owl habitat acres in 0.7 mile circle.

At Threshold: 2,663-3,994 total suitable spotted owl habitat acres in 1.8 mile circle.

Optimum/Target: > 3,994 total suitable spotted owl habitat acres in 1.8 mile circle.

[7] The activity center is within 1/2 mile of the CHU.

[8] **Inside** = activity center is at least 600' inside (forest interior) late successional habitat.

Near = activity center is inside late successional habitat that creates a forest interior.

[10] **Habitat** within 1.8 mile radius. Dry **suitable spotted owl habitat** includes vegetation code 12 where size/structure is multistory greater than 9" DBH; mesic Suitable includes code 22; and wet Suitable includes codes 32, 36, 62, 64, and 42 (see appendix 2 GIS Veg Model & appendix 3 Veg Photo Mapping Key). Use the highest quality habitat available.

[9] **Habitat** within 1.8 mile circle around activity center. Dry **dispersal habitat** includes vegetation codes 11, 13, and 52; mesic dispersal includes code 21; and wet dispersal includes codes 31, 35, 61, and 41.

[11] A larger circle than 1/3 mile radius will be used to develop **100 Acre Activity Center**, if there is less than 100 acres of suitable habitat.

(b) Critical Habitat Unit for Northern Spotted Owls

The Deadhorse LSR, Tumwater MLSA and Natapoc MLSA all overlap into Critical Habitat Unit WA-9, the LSR/MLSAs cover 75% of the CHU. The Deadhorse CHU overlaps into the Deadhorse LSR (13,720 acres of CHU), and should support 4+ pairs of spotted owls. The CHU overlaps into the Tumwater MLSA (2,692 acres of CHU) and should support 1 pair of spotted owls. The CHU overlaps into the Natapoc MLSA (135 acres of CHU), which could contribute support for 1 residential single. See appendix 13: LSR/MLSA S.Owl Acreage's, and Appendix 34: CHU Maps Wenatchee National Forest.

This Critical Habitat Unit was developed to provide essential nesting, roosting, foraging and dispersal habitat. Habitat in this unit is fragmented, with intermingled private and Federal ownership. Several critical habitat additions of suitable habitat improve the overall habitat quality of this unit, and improve linkage with adjacent CHUs. Breeding habitat connectivity is between the Deadhorse/Tumwater/Natapoc areas and the Chiwawa CHU, Little Wenatchee CHU, Icicle CHU, Boundary Butte CHU, and CHUs on the Mount Baker-Snoqualmie National Forest. (USFWS Memorandum, 1991)

The forested habitats of the Alpine Lakes Wilderness areas are particularly important for the functioning of this connectivity, specifically Chiwaukum Creek.

Spotted owl connectivity and sustainability were analyzed individually and collectively, see Appendix 1, "Forest Wide Spotted Owl Module" and "Individual LSR/MLSA Spotted Owl Module". The Critical Habitat Units were compared with LSRs and MLSAs, to determine if the reserves meet the intent of the CHU needs (connectivity, home range goals, juxtaposition, and range-wide distribution). The existing condition was then compared to sustainable spotted owl habitat.

It is recognized that the LSR/MLSAs were designed with the intent that habitat may be lost due to fire or other disturbances, while other LSR/MLSAs will increase in spotted owl habitat as late successional habitat is recovered. However, some LSR/MLSAs are in strategic locations for dispersal, connectivity and genetic interchange. Overtime, there is some question of sustainability of spotted owl habitat in 6 of the 27 LSR/MLSAs. The need is a long-term (>50 years) support for connectivity and home range goals for spotted owls in these LSR/MLSAs and across the province. The sustainability question is due to the amount of dry and mesic forested habitat at risk to fires in these 6 LSR/MLSAs.

The six LSR/MLSAs with sustainability questions are Swauk LSR, Shady Pass LSR, Deadhorse LSR, Boundary Butte LSR, Tumwater MLSA and Sand MLSA. In these areas, to strengthen connectivity, home ranges and spotted owl viability, parts of the CHUs may need to be maintained or adjusted. Adjusted areas should include wetter spotted owl habitat within spotted owl home ranges, which will strengthen the connectivity and species viability. Possible adjusted areas for LSR or MLSA important for spotted owl connectivity, but low in sustainability, include: Swauk LSR (wetter habitat to the north, see Forest-wide spotted owl module); Shady Pass LSR (habitat to the southeast in the Twenty-five Mile Creek CHU WA-4); Deadhorse LSR and Tumwater MLSA (all available wetter habitat is included in the LSR and CHU WA-9, monitor this reserve); Boundary Butte LSR (wetter habitat to the south, including spotted owls

inside the CHU WA-11); and Sand MLSA (wetter habitat to the south, including spotted owls inside the CHU WA-12).

In all LSR/MLSAs, except the six noted above, reserves are predicted to provide the needs for spotted owl recovery over time (50+ years). They will also provide the function the CHUs were designated for. Coupled with the LSR/MLSA management, riparian reserve function, Wilderness areas, and Unmapped LSRs, the needs of the spotted owl will be met. These reserves function for connectivity and spotted owl home ranges. It is concluded that the LSR/MLSAs meet the function of the CHU system, as intended in the NWFP (NWFP C-9). Monitoring and maintaining connections, as well as meeting LSR goals will be ongoing.

(c) Grizzly Bear and Gray Wolf

No class 1 grizzly bear observations have been made within the Natapoc MLSA, Tumwater MLSA or Deadhorse LSR, however, class 1 observations have been reported nearby (Almack et al. 1993). Grizzly bears are suspected to occur within all areas. No surveys have been completed in the Deadhorse MLSA or Tumwater MLSA and about 50% of the Natapoc MLSA has been surveyed. Gray wolves are suspected to occur within these areas and about 50% of their habitat in the Natapoc MLSA and none in the Deadhorse LSR or Tumwater MLSA has been surveyed.

(d) Marbled Murrelet

The Deadhorse LSR and Tumwater/Natapoc MLSAs do not include any marbled murrelet habitat, they are well outside the marine foraging zone.

(2) Sensitive Wildlife Species and Species of Concern

There are 15 wildlife species that are on the Regional Forester's Sensitive Species list or are USFWS species of concern that could occur within the Natapoc MLSA, Tumwater MLSA or Deadhorse LSR. These include the goshawk (*Accipiter gentilis*), willow flycatcher (*Empidonax trailii*), olive-sided flycatcher (*Contopus borealis*), tailed *frog (Ascaphus trueii*), spotted frog (*Rana pretiosa*), Cascade frog (*Rana cascadae*), Columbia pebblesnail (*Fluminicola columbiana*), long-legged myotis (*Myotis volans*), long-eared myotis (*Myotis evotis*), fringed myotis (*Myotis thysanoides*), Yuma myotis (*Myotis yumanensis*), Western big-eared bat (*Plecotus townsendii*), lynx (*Lynx canadensis*), fisher (*Martes pennanti*), and wolverine (*Gulo gulo*).

(a) Birds

The goshawk is known to occur in all three areas. Surveys have covered about 5% of the habitat within the Deadhorse LSR and 50% in the Natapoc and Tumwater MLSAs. It is unknown if the little willow flycatcher or the olive-sided flycatcher occur. No surveys have been completed in the Deadhorse LSR or Tumwater MLSA and about 10% of their habitat has been surveyed in the Natapoc MLSA.

(b) Amphibians

Surveys for amphibians have not been completed within the Natapoc MLSA, Tumwater MLSA or Deadhorse LSR. It is unknown if the tailed frog occurs in the Natapoc MLSA and suspected to occur in the Tumwater MLSA and Deadhorse LSR. The spotted frogs are known to occur in the Deadhorse LSR and unknown in the Natapoc MLSA and Tumwater MLSA. Cascades frogs are unknown in Tumwater MLSA and known to occur in both other areas.

(c) Mollusks

No surveys for the Columbia pebblesnail have been conducted and it is unknown if they are present.

(d) Mammals

Surveys for bat species have not been completed. It is unknown or suspected that the long-legged myotis, long-eared myotis, fringed myotis, Yuma myotis or the western big-eared bat occur in these LSRs or MLSAs.

Surveys for lynx, fisher and wolverine have not been conducted in any of the areas and it is unknown if they occur.

(3) Management Indicator Species

There are 12 wildlife species that are listed as management indicator species that occur or could occur within the Natapoc MLSA, Tumwater MLSA or the Deadhorse LSR. These species include the pileated woodpecker *(Dryocopus pileatus),* downy woodpecker (*Picoides pubescens*), hairy woodpecker *(Picoides villosus*), three-toed woodpecker (*Picoides tridactylus*), red-breasted sapsucker (*Sphyrapicua ruber*), Williamson's sapsucker (*Sphyrapicua thyroideus*), northern flicker (*Colaptes auratus*), ruffed grouse (*Bonasa umbellus*), mule deer (*Odocoileus hemnionus*), elk (*Cervus elephus*), beaver (*Castor canadensis*), and marten (*Martes americana*).

(4) Primary Cavity Excavators

No formal surveys for primary cavity excavators have been completed. The pileated woodpecker, downy woodpecker, hairy woodpecker, and northern flicker are known to occur in all areas.. It is unknown if the three-toed woodpecker, red-breasted sapsucker, and Williamson's sapsucker occur in any of the areas.

(a) Ruffed Grouse and Beaver

No surveys for the ruffed grouse or beaver have been completed. The beaver is suspected to occur in all areas and the ruffed grouse is known to occur in the Natapoc MLSA and suspected in the Tumwater MLSA and the Deadhorse LSR.

(b) Mule Deer, Elk

Surveys for mule deer and elk have covered about 100% of the available habitat and they are known to occur within all areas.

(c) Marten

Marten are suspected to occur in the Natapoc MLSA and Tumwater MLSA and none of their available habitat has been surveyed. In the Deadhorse LSR marten are known to occur and none of their habitat has been surveyed.

(5) Survey And Manage, Protection And Buffer Species

There are eight species that do or could occur within the Natapoc MLSA, Tumwater MLSA or Deadhorse LSR and are identified as survey and manage, or protection and buffer species. These include the great gray owl (*Strix nebulosa*), flammulated owl (*Otis flammeolus*), White-headed woodpecker (*Picoides albolarvatus*), black-backed woodpecker (*Picoides arcticus*), pygmy nuthatch (*Sitta pygmaea*), warty jumping slug (*Hemphillia glandulosa*), blue-gray tail-dropper (*Prophysaon coeruleum*), and papillose tail-dropper (*Prophysaon dubium*).

(a) Birds

It is suspected the great gray owl occurs within both Deadhorse LSR and Tumwater MLSA and surveys have been completed over 10% of their habitat in the Natapoc MLSA and none in the

Deadhorse LSR. It is unknown if they occur in the Tumwater MLSA and no surveys have been conducted. No surveys have been completed for the flammulated owl, white-headed woodpecker, black-backed woodpecker, or pygmy nuthatch. The flammulated owl is known to occur in the Deadhorse LSR, suspected in the Natapoc MLSA and unknown in the Tumwater MLSA. The white-headed woodpecker is unknown in the Tumwater MLSA and known to occur in both other areas. It is unknown if the pygmy nuthatch or black-backed woodpecker occur in the Tumwater MLSA or Deadhorse LSR and they are suspected in the Natapoc MLSA.

(b) Mollusks

It is unknown if the warty jumping slug, blue-gray tail-dropper, or papillose tail-dropper and no surveys have been completed.

(c) Habitat Effectiveness

Habitat effectiveness was measured using the current open road density and the amount of security habitat. The current open road density within the Natapoc MLSA is 3.7 mi./sq.mi. and the amount of area in security habitat is 5%. This information shows that habitat effectiveness is considered to be "low" (>2 mi./sq.mi.) relative to roads and "low" relative to security habitat (<50%).The current open road density in the Tumwater MLSA is 0.52 and the amount of security habitat is 59 %. This information indicates that habitat effectiveness relative to roads is "low" (< 1 mi./sq.mi.) and "moderate" (50-70 %) relative to security habitat. The current open road density in the Deadhorse LSR is 0.8 mi./sq.mi. and the area in security habitat is 57%. This information suggests that the habitat effectiveness relative to roads is considered to be "high" (<1 mi./sq.mi.) and "moderate" relative to security habitat (50-70%). The long term management objective for LSR/MLSAs is to manage towards a "high" level of habitat effectiveness defined as >1mi./sq.mi. open road density and >70% security habitat.

3. Human Uses

a) Overview

The Tumwater and Natapoc MLSA and Deadhorse LSRs include and are adjacent to private land that has been considerably altered due to human activities. U.S. Highway 2, an important east/west crossing of the Cascades, runs through and adjacent to the Tumwater MLSA and Deadhorse LSR. This stretch of highway has been included in the National Scenic Byways program, a designation formally recognizing the high quality of its scenic value. The mainline for the Burlington Northern Railroad runs through the Deadhorse LSR. A number of high voltage transmission and distribution electrical lines also pass through these areas.

b) Prehistoric and Historic Summary

The Wenatchee River provided an important travelway for American Indians as well as an abundant food source from the seasonal runs of salmon. Numerous sites have been discovered along the Wenatchee River. Excavations have yielded occupation dates beginning as far back as 2,000 years ago.

The Great Northern Railway provides an important element to the area's history. The railroad was constructed through Leavenworth and up Tumwater Canyon along the approximate route of U.S. Highway 2 in the 1890's. In addition to the railroad line, a dam creating Lake Jolanda, penstock and powerhouse were constructed in the early 1900's to provide electrical power to the railroad operation. In the late 1920's the railroad moved its mainline to the Chumstick Canyon. This Tumwater alignment was subsequently converted to use as an automobile highway, a use

that has continued to this day. The powerhouse and other power generation facilities were removed in the late 1950's, however the dam remains.

c) Recreation

(1) Campgrounds

The Deadhorse LSR includes the Tumwater Campground, a popular, 81 unit campground directly adjacent to U.S. Highway 2 just north of Tumwater Canyon. Deadhorse also includes the Swiftwater Picnic site, a popular highway wayside stop with easy access to the Wenatchee River.

(2) Dispersed Camping

Some dispersed camping occurs from hunters, recreationists and highway travelers in these areas. There are no concentrated areas of dispersed camping use.

(3) Trails

The Penstock Trail, located on the west side of the Wenatchee River in Tumwater Canyon within the Tumwater MLSA, is a non-system trail about one mile long. This is a popular day hike opportunity for casual hikers. The district has proposed developing additional small loop trails connected with the Penstock trail; however, no planning activities have been planned in the near future.

A non-motorized trail system, called the Tumwater Mountain Trail System has been proposed. This system would be bounded by the Wenatchee River to the west and north, Leavenworth to the south and the private lands of the Chumstick to the east. A master plan would be prepared in 1997/98 to develop the conceptual design and evaluate the feasibility for this system.

(4) Winter Use

Other than some limited cross country skiing and snow mobile use, few winter recreational activities occur.

(5) Other Recreation

Castle Rock, located in Tumwater Canyon on the east side of Highway 2 within the Tumwater MLSA is a popular climbing location. There are other locations in Tumwater Canyon that receive lesser amounts of climbing use. There is the potential that these sites could become more popular.

Fishing along the Wenatchee River is another popular activity.

The calmer stretch of the Wenatchee River extending from Lake Wenatchee to Tumwater Campground has long be popular for easy rafting and tubing trips. More recently the turbulent portion of the river running through Tumwater Canyon has become increasingly popular for kayakers.

d) Mining

There are no active mining operations within these areas. Historically there has been some exploration activity however, now there appears only a small degree of use of recreational dredges in the Wenatchee River.

e) Social and Economic Considerations:

These areas include or adjoin many private parcels, where residential development has occurred. This poses a challenge of managing rural/wildland interfaces as associated with fire.

The transportation corridors, both highway and railroad, are very important economic links with the Seattle metro area. The highway in particular is extremely important to the tourist oriented economy of Leavenworth as it provides the most direct route for many Seattle residents to visit the town. This highway has been subject to numerous closures in Tumwater Canyon due to snow avalanches, landslides and road damage resulting from flooding events. The highway was also temporarily closed during the fires of 1994 that burned here. These highway closures have caused significant economic distress to the tourism economy.

The number of powerline corridors are important in providing reliable electrical power to many of the business and residential developments on these lands as well as transporting it to other locations within the region.

B. Analysis Between LSR/MLSAs

1. Sustainability

a) Sustainability Analysis

The sustainability of LSRs/MLSAs across the Forest is displayed in Table 19, *Vegetation Hazard and Ignition Risk Ratings* of the "Forest-wide Assessment for Late Successional Reserves and Managed Late Successional Areas, Wenatchee National Forest". The Deadhorse LSR and the Natapoc MLSA fall in the upper one third of all LSR/MLSAs in terms of amount of vegetation at risk to loss from catastrophic fire. The Tumwater MLSA falls in the middle one third in terms of amount of at risk vegetation. An important consideration in terms of sustainability is the relationship between these three LSR/MLSAs and there neighboring LSR/MLSAs. This includes the amount of at risk vegetation within the LSR/MLSAs as well as the extent of at risk vegetation between them. For the purposes of this analysis six LSR/MLSAs are considered to be neighbors: Chiwawa; Eagle; Camas; Boundary Butte; Icicle; and, Little Wenatchee.

The following table shows a comparison of the acres at risk and the ignition risk determined in the Forest-wide sustainability analysis for the Deadhorse LSR, and the Natapoc and Tumwater MLSAs and their six neighboring LSR/MLSAs.

Table X-2, Acres at Risk and Ignition Risk, Deadhorse LSR and Natapoc and Tumwater MLSAs

LSR/MLSA	% of LSR/MLSA at Risk		% of LS Forest at Risk		Ignition Risk
	Acres	Pct.	Acres	Pct.	
Deadhorse	10,805ac	59%	9,843ac	100%	High
Natapoc	849ac	79%	670ac	100%	High
Tumwater	1,081ac	26%	1,054ac	100%	Moderate
Little Wenatchee	0ac	0%	0ac	0%	Moderate
Icicle	3,568ac	25%	3,268ac	38%	Moderate
Chiwawa	29,042ac	27%	21,345ac	38%	Moderate
Eagle	3,501ac	66%	3,163ac	100%	High

LSR/MLSA	% of LSR/MLSA at Risk		% of LS Forest at Risk		Ignition Risk
	Acres	Pct.	Acres	Pct.	
Deadhorse	10,805ac	59%	9,843ac	100%	High
Natapoc	849ac	79%	670ac	100%	High
Tumwater	1,081ac	26%	1,054ac	100%	Moderate
Camas	941ac	61%	932ac	100%	High
Boundary Butte	No Inform-ation				

The Deadhorse LSR lies between and adjacent to both the Natapoc and Tumwater MLSAs. The 1994 Hatchery fire burned 99% of the Tumwater MLSA and 6% of the Deadhorse LSR, as well as burning much of the at risk vegetation between the two. This event has lessened the likelihood of another catastrophic fire spreading from Tumwater to Deadhorse or vice versa. The Natapoc MLSA is adjacent to Deadhorse for almost half of its perimeter. For this reason any fire burning in one is likely to spread into the other.

When looking at sustainability issues between LSRs/MLSAs, the factor driving this analysis is the amount and location of at-risk vegetation between the Deadhorse LSR and the Natapoc and Tumwater MLSAs and their six neighbors. In other words, identifying linkages in at-risk vegetation that would facilitate the spread of fire from one LSR/MLSA to another. A review of at-risk vegetation maps reveals that this linkage does not exist between the Little Wenatchee LSR and these 3 LSR/MLSAs. The situation as it relates to Icicle and Boundary Butte LSRs and Camas MLSA was much influenced by the 1994 Rat and Hatchery fires. These two fires burned much of the at risk vegetation linking these LSR/MLSAs thereby much reducing the risk from future catastrophic fires in the short term.

There is a significant amount of at risk vegetation occurring between these 3 LSR/MLSAs and both the Chiwawa and Eagle LSRs. The potential for a fire occurring with resultant effects on all of these LSR/MLSAs at the same time is high, similar to what happened with the 1994 fires discussed previously.

(1) Implications

1. Reduce stand density in dense dry successionally advanced vegetation types (types 12 and 22 - Appendix 3) where they exist between Deadhorse, Natapoc , and Tumwater LSR/MLSAs and Chiwawa and Eagle LSRs. Of highest priority are those areas that also involve private land or urban interface issues in the Plain and Chumstick valleys.

Potential Projects - Commercial Thinning, Pruning

2. Encourage private land owners in the Plain and Chumstick Valley areas to take stand density management actions on private forested areas.

Potential Projects - Communicate need to local landowners.

3. Reduce fuel loading along roads that exist between these LSR/MLSAs and the Chiwawa and Eagle LSRs to increase the roads effectiveness as fuel breaks. The best chance for this is along the county road up the Chumstick Valley to Plain as many of the other roads in this area are oriented East and West and do not provide good opportunities for establishing fuelbreaks. Most of the Chumstick road is in private ownership so private landowners also play a role in implementing this opportunity as in item #2 above.

Potential Projects - Piling of down fuels, firewood gathering, pruning to reduce vertical fuel concentrations (all vegetation types), construction of shaded fuel breaks.

4. Improve and maintain the BPA powerline corridor as a fuelbreak between the Natapoc MLSA and the Chiwawa LSR.

Potential Projects - Plant or encourage growth of less flammable deciduous vegetation within the powerline corridor, remove dead fuels from the corridor.

5) Reduce fuel loading in young stands.

Potential Projects - Precommercial Thinning.

2. Forest-Wide Northern Spotted Owl

The Deadhorse LSR, Tumwater MLSA and Natapoc MLSA are not designated as a large population cluster/source center LSRs, for the recovery of the spotted owl. The Deadhorse, Tumwater and Natapoc LSR/MLSAs are part of the smaller "local population" centers, which are linked to the metapopulations through dispersing individuals (See Figures 1 and 2 with LSR and MLSA maps in the Forest-wide Assessment). The spotted owl is a Threatened species, with the recovery dependent on the implementation of the NWFP, especially in LSR/MLSAs (FSEIS Appendix G, Biological Opinion, 1994).

3. Connectivity (Plant, Wildlife, and Northern Spotted Owl)

a) Plant Connectivity

Connectivity can be addressed at several spatial scales when assessing an individual LSR or MLSA. Connectivity of the LSR'S/MLSA network on the Wenatchee National Forest has been addressed in Chapter VII of the Forest-Wide Assessment and in Appendix 1. Vascular plant connectivity with surrounding LSRs or MLSAs is analyzed in the tables in this section. Refer to Forest-wide Assessment discussions for connectivity descriptions of lichens, bryophytes and fungi.

Table X-3, Deadhorse -- Vascular Plant Connectivity

	Vegetation Group														
LSR/MLSA	**Dry/Mesic**			**Moist GF**			**Subalpine**			**Wet**			**Whitebark**		
Dispersal Class	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
Natapoc	Y	Y	Y	Y	Y	Y									
Tumwater	Y	Y	Y	N	D	D									
Little Wenatchee	A	A	A	N	D	D									
Chiwawa	D	D	Y	D	D	Y									
Eagle	D	D	D	N	D	D									
Camas	D	D	D	N	D	D									
Icicle	D	Y	Y	N	D	D									

Dispersal Codes = Y=Yes (Connectivity); N=No (Not Connected); A=Veg Group Absent; D=Dependent (Connectivity Depends on Outside Habitat)

Relative to the Deadhorse LSR, species within the dry and mesic vegetation types for all dispersal classes are well-connected with the Tumwater and Natapoc MLSAs, largely because of their close proximity. Low and moderate dispersal ability species are dependent on vegetation between LSRs or MLSAs for connectivity with Boundary Butte, Chiwawa, and Icicle LSRs and Eagle and Camas MLSAs. High dispersal species within the dry and mesic vegetation types are connected, however, to the Icicle and Chiwawa LSRs. This vegetation type is absent in the Little Wenatchee LSR, so no connectivity exists. The trends are similar in the moist grand fir group. All dispersal classes are well-connected with the Natapoc MLSA. However, low dispersal species are not connected to the Tumwater, Eagle, and Camas MLSAs and Icicle, Boundary Butte, and Little Wenatchee LSRs. Connectivity for these species, and moderate dispersal species, is dependent on vegetation outside the LSR/MLSA network for connectivity with the Chiwawa LSR. Species within the high dispersal class are connected with the Chiwawa LSR, but connectivity for moderate and high dispersal species with the rest of the surrounding LSRs or MLSAs is dependent on moist grand fir vegetation outside the network.

Table X-4, Natapoc -- Vascular Plant Connectivity

	Vegetation Group														
LSR/MLSA	**Dry/Mesic**			**Moist GF**			**Subalpine**			**Wet**			**Whitebark**		
Dispersal Class	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
Deadhorse	Y	Y	Y	Y	Y	Y									
Tumwater	Y	Y	Y	N	D	D									
Little Wenatchee	A	A	A	N	D	D									
Chiwawa	D	D	Y	D	D	Y									
Eagle	D	D	D	N	D	D									
Camas	D	D	D	N	D	D									
Icicle	D	Y	Y	N	D	D									

Dispersal Codes = Y=Yes (Connectivity); N=No (Not Connected); A=Veg Group Absent; D=Dependent (Connectivity Depends on Outside Habitat)

Presence, absence, and dependence of connectivity for the Natapoc MLSA and the surrounding LSRs and MLSAs is the same as described in the discussion above for the Deadhorse LSR and as shown in Table X-4, Natapoc -- Vascular Plant Connectivity for the Natapoc MLSA.

Table X-5, Tumwater -- Vascular Plant Connectivity

	Vegetation Group														
LSR/MLSA	**Dry/Mesic**			**Moist GF**			**Subalpine**			**Wet**			**Whitebark**		
Dispersal Class	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
Natapoc	Y	Y	Y	N	D	D	A	A	A						
Deadhorse	Y	Y	Y	N	D	D	A	A	A						
Little Wenatchee	A	A	A	N	D	D	N	N	D						
Chiwawa	D	D	D	N	D	D	N	N	N						
Eagle	D	D	D	N	D	D	A	A	A						

	Vegetation Group														
LSR/MLSA	**Dry/Mesic**			**Moist GF**			**Subalpine**			**Wet**			**Whitebark**		
Dispersal Class	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
Natapoc	Y	Y	Y	N	D	D	A	A	A						
Deadhorse	Y	Y	Y	N	D	D	A	A	A						
Camas	D	D	D	N	D	D	A	A	A						
Icicle	D	D	Y	N	D	D	N	D	D						

Dispersal Codes = Y=Yes (Connectivity); N=No (Not Connected); A=Veg Group Absent; D=Dependent (Connectivity Depends on Outside Habitat)

Connectivity for species within the dry and mesic vegetation types for the Tumwater MLSA is almost identical as described above for the Deadhorse LSR. Within the moist grand fir type, however, no connectivity exists for low dispersal species with surrounding LSRs or MLSAs. Species within the moderate and high dispersal classes are dependent upon vegetation outside the network for connectivity with all surrounding LSRs or MLSAs. Species associated with the subalpine fir series are either not connected or dependent on vegetation outside the network for connectivity. Natapoc, Tumwater, Eagle, and Camas MLSAs do not support this series.

(1) Restoration Opportunities

No specific projects were identified to improve connectivity between LSRs or MLSAs. Disconnectivity is due to inherent breaks breaks within the landscape. It is noted, however, that connectivity for *Iliamna longisepala*, which is associated with the dry forest group, could be improved by creating or maintaining fire climax ponderosa pine within and between LSRs or MLSAs where this species occurs.

b) Wildlife Connectivity

Connectivity between late-successional patches is important to providing movement between patches, minimizing local extinctions, and reducing genetic isolation (Harris 1984, Noss and Harris 1986). In order to assess connectivity between the Deadhorse LSR and adjacent LSR/MLSAs the dispersion index was used. A total of four potential linkages were evaluated: Deadhorse to Chiwawa LSR, Deadhorse to Tumwater MLSA, Deadhorse to Natapoc MLSA, and Deadhorse to Icicle LSR. The overall dispersion index for this LSR was 2.0.

Table X-6, Dispersion Indices for the Deadhorse LSR

Linkage	Distance(Miles)	High	Moderate	Low	Index
DH-Chiwawa	2.5	Yes	No	No	1
DH-Tumwater	0	Yes	Yes	Yes	3
DH-Natapoc	0	Yes	Yes	Yes	3
DH-Icicle	1.5	Yes	No	No	1
Overall					**2.0**

A total of four potential linkages were evaluated: Tumwater to Deadhorse MLSA, Tumwater to Icicle LSR, Tumwater to Boundary Butte LSR, and Tumwater to Eagle Creek MLSA. The overall dispersion index for this LSR was 1.75.

Table X-7, Dispersion Indices for the Tumwater MLSA

Linkage	Distance(km)	High	Moderate	Low	Index
TW-Deadhorse	0	Yes	Yes	Yes	3
TW-Icicle	3	Yes	Yes	No	2
TW-Boundary Butte	5	Yes	No	No	1
TW-Eagle Creek	10	Yes	No	No	1
Overall					**1.8**

A total of four potential linkages were evaluated: Natapoc to Chiwawa LSR, Natapoc to Deadhorse LSR. The overall dispersion index for this LSR was 2.0.

Table X-8, Dispersion Indices for the Natapoc LSR

Linkage	Distance(Miles)	High	Moderate	Low	Index
NAT-Chiwawa	2.5	Yes	No	No	1
NAT-Deadhorse	0	Yes	Yes	Yes	3
Overall					**2.0**

c) Northern Spotted Owl Connectivity

These LSR/MLSAs were established to compensate for fragmented habitat, intermingled with private land, and is important for range-wide distribution of owl habitat, which is on the northeastern edge of the range. The Deadhorse LSR was first established to provide for 4 pairs of spotted owls, the Tumwater was added to provide for an additional owl pair. Habitat in and near Natapoc MLSA was added to provide for an additional single owl site.

Dispersal probably occurs most along the northern aspects east and west of these LSR/MLSAs. Connectivity to other LSRs/MLSAs occur to the east (Chiwawa LSR), to the west/southwest (Icicle LSR) and to the west/northwest (Little Wenatchee LSR). For final recovery of the northern spotted owl, smaller LSRs/MLSAs contribute to the goal of occupied home ranges (See table below). The Deadhorse LSR, Tumwater MLSA and Natapoc MLSA were discussed as a Northern Spotted Owl Critical Habitat Unit. The goal of a total of 6 pairs of spotted owls for these 3 LSR/MLSAs are noted in the CHU discussion. If all potential habitat (13,060 acres) were sustainable for spotted owls in this LSR and MLSAs, 4+ pairs could be maintained. However, over time (50 years), it is expected that the Deadhorse, Tumwater and Natapoc LSR/MLSAs do not have enough sustainable habitat (moist forest groups) on National Forest lands to support 6 pairs of owls.

Table X-9, Connectivity Between LSRs: Spotted Owl Pair Goals for LSRs and MLSAs, and CHUs

LSR or MLSA Status and Connectivity	S.Owl Pairs --1994, FSEIS Appendix G, Table G-3	Highest Occupancy and Reproductive Status, for Field Seasons 1995 ---- 1996		Number of Owl Pairs CHU Should Support, as per USFWS - CHU discussion.	
Chiwawa RW 135	11 Pairs + 1 Res Single	16 Pairs + 3 Res Singles	18 + 1[1] (6 Sites*)	21+ Pairs	WA-6

LSR or MLSA Status and Connectivity	S.Owl Pairs --1994, FSEIS Appendix G, Table G-3	Highest Occupancy and Reproductive Status, for Field Seasons 1995 ---- 1996		Number of Owl Pairs CHU Should Support, as per USFWS - CHU discussion.	
Lil' Wenatchee RW134	3 Pr	9 Pr	9 Pr	7+ Pr	WA-7 & WA-8
Natapoc DM2	--	0	0	1 RS	WA-9
Deadhorse RW133	4 Pr	7 Pr + 2 RS	7 sites + 1[1] (2 Sites*)	4+ Pr	WA-9
Tumwater DM3	--	1 Pr	1 sites*	1 Pr	WA-9
Icicle RW132	1 Pr	2 Pr	2 sites	1 Pr	WA-10
Eagle DM5	--	1 Pr	1 site	--	NA
Boundary Butte RW131	3 Pr	2 Pr	2 sites*	3 Pr	WA-11

[1] Spotted owl activity center within 1/4 mile of LSR/MLSA boundary.

*S.owl activity center may have been lost, due to 1994 Chelan Forest Fires, monitoring still underway.

[2] Spotted owl activity center on Private Land.

Objectives in the Deadhorse LSR, Tumwater and Natapoc MLSAs should protect and enhance conditions of late successional and old growth forest ecosystems, while serving as habitat for late successional forest related species, including the northern spotted owl (NWFP A-4, 1994). LSRs and MLSAs are important for maintaining well distributed and well-connected spotted owl populations.

The five nearest LSR/MLSAs were evaluated to determine their potential for dispersal to occur. This analysis showed that spotted owls could likely disperse from Natapoc to Beaver Creek into the Chiwawa LSR; from the Deadhorse to Chiwaukum Creek and Cabin Creek into the Icicle LSR; from the Deadhorse through upper Coulter Creek to Whitepine into the Little Wenatchee LSR; and on into LSRs on the west-side of the Cascade Crest.

Spotted owl dispersal and connectivity are difficult, but could occur from Eagle MLSA, through Eagle Creek to Freund into Deadhorse LSR. Connectivity to Boundary Butte LSR and beyond into Swauk LSR is difficult, especially as a result of the Hatchery Creek and Rat Creek fires of 1994. Some dispersal habitat does occur across Tumwater Mountain, Icicle Ridge, Mountain Home and into Boundary Butte. These connections are possible, but dispersal would take a high degree of effort, due to severe fragmented fragmentation. See Forest Interior Map and Suitable Spotted Owl Habitat Maps. Connectivity corridors should be monitored for effectiveness, and should overlap into Riparian Reserves, unmapped LSRs, wilderness, etc.

(1) Restoration Opportunities And Potential Projects Between LSRs

1. Meet 6+ pair goals of LSR/MLSA for spotted owls.
2. Monitor potential to support 6+ pairs.

3. Protection of LSR/ MLSA from outside on Matrix lands, in the Chumstick, Natapoc, Nason Creek and Hatchery Creek areas. Reduction of fire into LSR/MLSAs.
4. Monitor/maintain connectivity inside and outside the LSR/MLSAs:
   - Outside LSR Connectivity: Icicle Ridge, Chiwaukum Creek, Coulter Creek/Whitepine, Natapoc/Beaver Creek, Tumwater Mountain, Freund Canyon/Eagle Creek, Mountain Home Ridge.
   - Inside LSR/MLSA Connectivity: Deadhorse/Skinney, Natapoc Ridge/Mountain, Wenatchee River Bowl, headwaters Sunitsch/Spromberg, Tumwater Mountain.

C. Analysis Within the LSR

1. Unique Habitats And Species

The following is the discussion and results of the Unique Habitat and Species module for the Deadhorse LSR/Tumwater MLSA/Natapoc MLSA. For more information see Unique Habitats Maps, Unique Habitats and Species Table (page 117-120 or Appendix __), Forest Interior Map and Tables (appendix 19), Riparian Reserves Map, Road Density tables (appendix 20). For process see Unique Habitats and Species Module in Appendix 1 for order, explanations and process of modules.

a) Forest-wide Overview of Unique Habitats and Species:

(1) Unique Ecosystems Landscape Analysis

Each LSR/MLSA is compared Forest-wide for unique habitats and species abundance, connectivity and function (See the "Function of the Network for Unique Habitats and Species", Chapter VII, Forest-wide Assessment). The Tumwater MLSA is quite diverse in unique habitats, the Deadhorse LSR has some excellent quality habitats near the Wenatchee River,and the Natapoc MLSA is limited in variety of unique habitats.

Forest-wide the Deadhorse LSR/Tumwater MLSA/Natapoc MLSA are of low to moderate quality for providing unique habitats and species abundance, compared to the other LSR/MLSAs. These MLSAs/LSR provides low to moderate amounts of connectivity for unique habitats and species. However, the Tumwater MLSA does have one of the highest amounts of Sensitive plant species in one area on the Forest.

Table X-10, Unique Habitats Overview by LSR/MLSA

UNIQUE HABITATS	DEADHORSE LSR	TUMWATER MLSA	NATAPOC MLSA
Non-Forest Vegetation	8% (1,468 acres)	25% (1,029 acres)	3% (35 acres)
Forest Interior	2% (298 acres)	1% (48 acres)	7% (73 acres)
Late Successional/Wetter	9% (1,521 acres)	8% (334 acres)	5% (51 acres)
L-S Advanced/Fire Climax	45% (8,322 acres)	18% (745 acres)	58% (620 acres)
Wildlife Species - Known L-S and PETS	25 species	35 species	27 species
Plant Species - Known L-S and PETS	25 species	8 species	19 species

The Deadhorse LSR/Tumwater MLSA and Natapoc MLSA are within the Wenatchee Mountains area of plant rarity or endemism along the east-west ridges east of the Cascades, as per Columbia Basin Ecosystem Plan (Marcot et al, 1995). The Chiwaukum Creek Potential RNA (WNF LRMP 1990) for grand fir/mixed conifer/conifer shrub community is within the Alpine Lakes Wilderness, adjacent to the Deadhorse LSR The Tumwater Botanical Area is identified to protect plant species in a near natural area. The Tumwater Botanical Area was initially set up for Wenatchee Rock-rose (*Lewisia tweedyii*), further research in the area has found abundance of rare plants such as *Hackelia venusta, Silene seelyi, Chaenactis ramosa.* Within the Deadhorse LSR, there are two Special Interest Areas identified in the WNF Plan, they are for Cultural Significance along the Wenatchee River.

Identified areas of high abundance, connectivity and function for unique habitats and species within the Deadhorse/Tumwater/Natapoc LSR/ MLSAs are:

- **Wenatchee River** (from Plain to Leavenworth): gravel-bars, wetlands, Riparian Reserves, Forest Interior, PETS spp, MIS spp, fresh water mussels, bald eagles, salmon, steelhead, coho, Native American sites.
- **Sunitch to Spromberg**: Natural Openings, Forest Interior, Security Habitat, PETS Spp, Riparian Reserves.
- **Mica Canyon:** Deciduous Forest - aspen.
- **Deadhorse Canyon:** Riparian Reserves, Security Habitat, Excellent Forest Interior, PETS Spp.
- **Tumwater Botanical Area:** 7 sensitive plants species, including *Hackelia venusta.* High concentration of *Lewisia tweedyii.* Native American sites pectroglyphs and pictographs.
- **Natapoc Mountain:** Large older ponderosa pines, sandstone cliffs.

Each LSR/MLSA can be evaluated for biodiversity, connectivity and function (see Function of Unique Habitats in the main body of the Forest-wide Assessment, Chapter VII pages 115-116). Past management activities affect the function of unique habitats and species. This includes open roads, roading of riparian reserves, and past harvest activities.

For the Deadhorse LSR: total open road density of 0.80 miles per square mile; security habitat of 57%; roads and trails in riparian reserves of 3.58 miles per square mile; and past harvest activities of 12% in the LSR.

For the Tumwater MLSA: total open road density of 0.52 miles per square mile; security habitat of 59%; roads and trails in riparian reserves of 4.05 miles per square mile; and past harvest activities of 33% in the LSR.

For the Natapoc MLSA: total open road density of 3.71 miles per square mile; security habitat of 5%; roads and trails in riparian reserves of 12.78 miles per square mile; and past harvest activities of 2% in the LSR. Road densities appear high, due to the small area of this MLSA..

(2) Abundance and Ecological Diversity

Compared to all the other LSR/MLSAs, the Tumwater provides moderate amounts of unique habitats and variety of plant communities and environments. The Deadhorse/Natapoc provide low amounts of unique habitat acreage and low variety of plant communities and environments. This includes acreage for unique plant and animal habitats, juxtaposition of habitats, availability of wilderness or areas of rarity, and known observations from the plant and animal species list. There is 3% to 25% of these LSR/MLSAs in non-forest vegetation. There are 25 to 35 wildlife

species associated with Late-successional habitat or are Species of Special Status. There are 8 to 25 plant species known that are associated with Late-successional or special status in these 3 LSR/MLSAs. See Appendix 37.

(3) Connectivity for Unique Habitats and Species

The Tumwater has moderate quality providing connectivity in a landscape pattern for biological flow to sustain unique animal and plant communities. The Deadhorse/Natapoc has lower quality connectivity. This includes the amount, percent and number of patches of late successional habitat, forest interior habitat patches, and the juxtaposition of wilderness and areas of rarity.

(4) Process and Function of Unique Habitats and Species

The Tumwater is in the moderate group, and Deadhorse/Natapoc is in the low group for the Forest in providing quality functioning for unique species and habitat. This includes development and maintenance of unique ecosystems, including ecological values for unique species and populations. The plant and animal species list for known observations makes up a large part of this analysis, as well as proximity to wilderness and areas of rarity, which sustain habitat function. See Chapter VII, Forest-Wide Function of the Network for Unique Habitats and Species and in Appendix 37 "Forest-wide Unique Habitats and Species by LSR/MLSA".

b) Unique Habitats and Species Known Within LSR/MLSA

(1) Unique Habitats and Species Site Specific Analysis

The following is a summary of the Unique Habitats and Species Module for Deadhorse, Tumwater and Natapoc LSR/MLSAs. For more information see Unique Habitats Map and Tables, Forest Interior Map and Tables, Riparian Reserves and Roading Map and Tables.

	Deadhorse LSR	**Tumwater MLSA**	**Natapoc MLSA**
Riparian Reserves	Over-all 10% of LSR in riparian, low amounts.	Over-all 11% of LSR in riparian, moderate amounts.	Over-all 10% of LSR in riparian, low amounts.
	Streams (1684 acres), Open water (170 acres) one of highest amounts on Forest, Wet Meadows (22 acres), and Seeps.	Streams (326 acres), Open water (115 acres) one of highest amounts on Forest, Wet Meadows (trace acres), and Seeps.	Streams (102r acres), Open water (9 acres), Wet Meadows (0 acres), and Seeps.
Non-Forested Vegetation	8% (1468 acres) of LSR		
	Talus 1% (213 acres), Rock 0%, Cliff 1% (86 acres),	Talus 1% (47 acres), Rock 1% (61 acres), Cliff 16% (673 acres) very high amount,	Talus 0% (0 acres), Rock 0%, Cliff 1% (6 acres),
	Subalpine Meadows 0%, Dry Meadows (80	Subalpine Meadows trace % (9 acres), Dry	Subalpine Meadows 0%, Dry Meadows (6

	Deadhorse LSR	Tumwater MLSA	Natapoc MLSA
	acres),	Meadows (0 acres),	acres),
	Natural Openings 2% (393 acres), Shrub/Brushfields 1% (293 acres)	Natural Openings <1% (14 acres), Shrub/Brushfields 3% (111 acres)	Natural Openings 0% (0 acres), Shrub/Brushfields 0% (0 acres)
Unique Forest Groups	Forest Interior Patches 2% (298 acres) very low amounts.	Forest Interior Patches 1% (48 acres) very low amounts.	Forest Interior Patches 7% (73 acres) very low amounts.
	Deciduous Trees 1% (62 acres),	Deciduous Trees trace %,	Deciduous Trees 0% (0 acres),
	Dry Forests; Disjunct Cedar, Aspen, Black Cottonwood.	Dry Forests; Disjunct Cedar, Aspen, Black Cottonwood.	Dry Forests; Western Red Cedar.
	Whitebark Pine/Subalpine Larch 0%,	Whitebark Pine/Subalpine Larch Trace %,	Whitebark Pine/Subalpine Larch 0%,
	Snags/Logs low-moderate Quality from Landscape Level	Snags/Logs low Quality from Landscape Level	Snags/Logs low Quality from Landscape Level
Animal - Late Successional Associated Species and Species of Special Status	25 Species of Special Animals	35 Species of Special Animals	27 Species of Special Animals
PETS - Animals	7 species: Spotted Owl, Bald Eagle, Grizzly Bear, Gray Wolf, CHU, Red Band Trout, Spotted frog.	7 species: Spotted Owl, Bald Eagle, CHU, Grizzly Bear, Gray Wolf, Common Loon, Red Band Trout.	5 species: Spotted Owl, CHU, Bald Eagle, Grizzly Bear, Gray Wolf.
Survey & Manage and Protection & Buffer	2 species: Flammulated Owl, White-headed woodpecker	0 species:	1 species: White-headed woodpecker
Management Indicator Species (WNF)	11 Species: Bald Eagle, Spotted Owl, Marten, Pileated Woodpecker,	10 Species: Bald Eagle, Spotted Owl, Marten, Pileated Woodpecker, Primary Cavity Excavators,	7 Species: Bald Eagle, Spotted Owl, Pileated Woodpecker, Primary Cavity Excavators, Ruffed Grouse, Elk,

	Deadhorse LSR	Tumwater MLSA	Natapoc MLSA
	Primary Cavity Excavators, Beaver, Ruffed Grouse, Elk, Mule Deer, Cutthroat Trout, Red Band Trout.	Beaver, Ruffed Grouse, Elk, Mule Deer, Mountain Goat, Red Band Trout.	Mule Deer.
Other Animal Species of Special Status	6 Species of Concern: Harlequin Duck, Northern Goshawk, California floater mussel, Cascades Frog.	2 Species of Concern: Harlequin Duck, Northern Goshawk.	1 Species of Concern: Northern Goshawk
	1+ Birds: along the streams, rivers, shrub fields, meadows. Common merganser	2 + Birds: along the streams, rivers, shrub fields, meadows. Common merganser, wood duck.	3+ Birds: along the streams, rivers, shrub fields, meadows. Winter wren, Hermit thrush, Varied Thrush.
	8+ Late Successional Species: Barrow's Goldeneye, Cascade's frog, Barred owl, pygmy owl, saw-whet owl, hairy woodpecker, Cooper's hawk, Big-brown bat.	3+ Late Successional Species: Barred owl, saw-whet owl, hairy woodpecker	8+ Late Successional Species: Cascade's frog, Northern alligator lizard, Barred owl, pygmy owl, saw-whet owl, hairy woodpecker, Brown creeper, Flying squirrel.
	Significant Fish Populations: Redband in Chiwaukum Creek, Summer/Fall Chinook, Steelhead, Coho restoration.	Significant Fish Populations: Summer/Fall Chinook, Steelhead, Coho restoration.	Significant Fish Populations: Summer/Fall Chinook in Wenatchee River section of MLSA.
Plants - Late Successional Associated Species and Species of Special Status	25 species of Special Plants	8 species of Special Plants	29 species of Special Plants
PETS - Plants	2 species: *Cypripedium fasiculatum,*	7 species: *Chaenectis ramosa, Cypripedium fasiculatum, Hackelia*	3 species: *Botrychium montanum, Cypripedium*

	Deadhorse LSR	Tumwater MLSA	Natapoc MLSA
	Orbanche pinorum.	*venusta, Illiamna longsepela, Orbanche pinorum, Saxifrage, Silene seelyii.*	*fasiculatum, Orbanche pinorum.*
Survey & Manage and Protection and Buffer Plants	Fungi (2 species), Lichens, Vascular Plants (2 species)	Fungi (0 species), Lichens, Vascular Plants (0 species)	Fungi (2 species), Lichens, Vascular Plants (2 species)
Other Plant Species of Special Status	19 late-successional associated species	1+ late-successional associated or other species: *Lewisia tweedyii.*	12+ late-successional associated species
American Indian Uses	Traditional Use Sites: Dwelling/home sites and camp sites along Wenatchee River, Travel routes up and down valley, lithic scatters.	Traditional Use Sites: Dwelling/home sites and camp sites along Wenatchee River, Travel routes up and down valley, lithic scatters.	Traditional Use Sites: Travel/hunting routes on ridges.
	Vision Quest Sites: Potential vision quest in rock and off major ridges and peaks.	Vision Quest Sites: Rock art (pictographs and petroglyphs), Potential vision quest in rock and off major ridges and peaks.	Vision Quest Sites: Potential vision quest in rock and off major ridges and peaks.
	Traditional Food Plants: Bitter-root collection.	Traditional Food Plants: Bitter-root collection.	Traditional Food Plants: Bitter-root collection.
	Food Gathering: Salmon fishing, Deer hunting.	Food Gathering: Salmon fishing, Deer hunting.	Food Gathering: Deer hunting.

c) Deadhorse/Tumwater/Natapoc Potential Treatments For Unique Habitats And Species:

- **WEEDS** (Diffuse and Spotted Knapweed, Dalmatian Toadflax):
  1. Keep weeds from encroaching into LSR, especially into meadows and natural openings;
  2. Reduce noxious weed spread on roads through-out the LSR;
  3. Reduce noxious weeds in fire areas, especially on roads, safety-zones and landings.
- **ROADS**

4. Reduce roads/trails/campgrounds in Riparian Reserves and wet meadows both inside and outside of MLSA;
5. Increase Security Habitat especially in Natapoc MLSA;
6. Reduce open road density.
7. Reduce roads in forest interior patches;

- **ACCESS**

8. Retain American Indian access to traditional use sites;

- **HABITAT IMPROVEMENT**

9. Use prescribed fire in ponderosa pine for low density and large tree sizes, particularly for PETS plant species.
10. Thin to accelerate late successional characteristics.
11. Reduce encroaching trees in subalpine meadows and shrubfields; where fire historically maintained them as meadows,.

- **PROTECT**

12. Protect and maintain or improve PETS plant habitat in highway corridor.
13. Protect and enhance riparian areas, wetlands, intermittent streams, and dispersal corridors in Riparian Reserves;
14. Protect large trees and screen near cliffs, caves, meadows;
15. Meet high end snag levels and spp;
16. Protect caves and cliff/caves for 250' around (roads/trails/cutting) to benefit bat species.
17. Protect 300' around subalpine meadows. Buffer around meadows in Mica Canyon.

- **COORDINATE**

18. Acquire non-Forest System lands with high degree of unique species or habitat.
19. Coordinate unique habitat management on private lands OR acquire habitat from private ownership, for habitat diversity and for connectivity.

- **INTERPRET**

20. Interpret values and protect/maintain unique habitats and species.

- **MONITOR:**

21. Protect/maintain/enhance/monitor PETS species.
22. Monitor viability concerns for PETS species.
23. For Sensitive and Listed plant species augment or re-introduce species (Have).
24. Monitor and maintain unique habitat concentrations;
25. Monitor and maintain connectivity corridors.
26. Survey & Manage prior to activities: Great Gray Owl, Larch Mt. Salamander, Lynx, Mollusks and other S&M or P&B species;.
27. Survey & Manage prior to activities: fungi, lichen, bryophytes, vascular plants.

28. Follow PETS, Species of Concern, Species of Special Status guidelines in Biological Evaluations for projects.

- **HABITAT IMPROVEMENT**

29. Use of Prescribed Fire to improve ponderosa pine fire climax forests.

d) Snag/Log/Green Tree Recruitment Module

The following is the discussion and results of the Snag/Log/Green Tree Recruitment sub-set module of the Unique Habitats module for the Deadhorse LSR/Tumwater MLSA/Natapoc MLSA. See appendix for order, explanations and process of modules. Snag quality can be judged by a continual supply of tree structure in various stages of decay, size and species. This can be best provided in the moist and wet vegetation groups, areas with large amounts of late-successional habitat, areas with little fragmentation, areas with high amounts of forest interior, and areas with high functioning riparian reserves. (See "LSR/MLSA Snag/Downed Logs/Green Tree Recruitment Analysis" Appendix 38, Forest-wide Assessment)

Table --X-11--, Deadhorse LSR Snag Habitat Quality/Landscape Scale

HIGH QUALITY	MEDIUM QUALITY ***	***LOW QUALITY
Moist & Wet Veg Groups **13%**	Subalpine Fir & Mesic Veg **13%**	Dry & Whitebark Veg **65%**
>60% LS (non-dry) Habitat	15% - 60% LS Habitat	<15% LS Habitat **8%**
80% - 100% LS (all) Habitat	40% - 80% LS/M Habitat **54%**	<40% LS/M Habitat
> 30% Forest Interior (non-dry)	15% -29% Forest Int Non-dry	<15% Forest Interior Not Dry **0%**
>10% Forest Interior Dry	5% - 9% Forest Interior Dry	< 5% Forest Interior Dry **2%**
>16% in Riparian Reserves	10% to 16% in Riparian Reserves	<10% in Rip Res **9%**
0 Mi/Sq Mi Any Rds in Rip Res	0 to 1 Mi/Sq Mi Rds in Rip Res **0.80 mi/sq/mi**	> 1 Mi/Sq Mi Rd Rip Res
< 1 Mi/Sq Mi Open Roads	1 Mi to 2.5 Mi/Sq Mi Roads	> 2.5 Mi/Sq Mi Roads **3.58 mi/sq/mi**
>70% Security Habitat	50% to 70% Security Habitat **57%**	<50% Security Habitat
>10% Past Burns Provide Snags **>10%%**		<10% Past Burns Provide Snags
>50% Insect/Pathogens (See Disturbance Section in this Chapter)	25% - 50% Insect/Pathogens **25% - 50%**	< 25% Insect/Pathogens
<10% Past CC Harvest **9%**	11% - 25% Past CC Harvest	>25% Past CC Harvest
<10% Past PC Harvest **3%**	11% - 50% Past PC Harvest	>50% Past PC Harvest

(Percentages in bold indicate values for LSR)

Table --X-12--, Tumwater MLSA Snag Habitat Quality/Landscape Scale

HIGH QUALITY	MEDIUM QUALITY	***LOW QUALITY
Moist & Wet Veg Groups **11%**	Subalpine Fir & Mesic Veg **11%**	Dry & Whitebark Veg **52%**
>60% LS (non-dry) Habitat	15% - 60% LS Habitat	<15% LS Habitat **8%**
80% - 100% LS (all) Habitat	40% - 80% LS/M Habitat	<40% LS/M Habitat **26%**
> 30% Forest Interior (non-dry)	15% -29% Forest Int Non-dry	<15% Forest Interior Not Dry **0%**
>10% Forest Interior Dry	5% - 9% Forest Interior Dry	< 5% Forest Interior Dry 1%
>16% in Riparian Reserves	10% to 16% in Riparian Reserves	<10% in Rip Res **8%**
0 Mi/Sq Mi Any Rds in Rip Res	0 to 1 Mi/Sq Mi Rds in Rip Res **0.52 mi/sq/mi**	> 1 Mi/Sq Mi Rd Rip Res
< 1 Mi/Sq Mi Open Roads	1 Mi to 2.5 Mi/Sq Mi Roads	> 2.5 Mi/Sq Mi Roads **4.05 mi/sq/mi**
>70% Security Habitat	50% to 70% Security Habitat **59%**	<50% Security Habitat
>10% in Past Burns **>10%**		<10% in Past Burns
>50% Insect/Pathogens (See Disturbance Section in this Chapter)	25% - 50% Insect/Pathogens **25%-50%**	< 25% Insect/Pathogens
<10% Past CC Harvest **<10%**	11% - 25% Past CC Harvest	>25% Past CC Harvest
<10% Past PC Harvest **0%**	11% - 50% Past PC Harvest	>50% Past PC Harvest

(Percentages in bold indicate values for LSR)

Table --X-13--, Natapoc MLSA Snag Habitat Quality/Landscape Scale

HIGH QUALITY	MEDIUM QUALITY	***LOW QUALITY
Moist & Wet Veg Groups **9%**	Subalpine Fir & Mesic Veg **22%**	Dry & Whitebark Veg **66%**
>60% LS (non-dry) Habitat	15% - 60% LS Habitat	<15% LS Habitat **5%**
80% - 100% LS (all) Habitat	40% - 80% LS/M Habitat **63%**	<40% LS/M Habitat
> 30% Forest Interior (non-dry)	15% -29% Forest Int Non-dry	<15% Forest Interior Not Dry **0%**
>10% Forest Interior Dry	5% - 9% Forest Interior Dry **7%**	< 5% Forest Interior Dry

HIGH QUALITY	MEDIUM QUALITY	***LOW QUALITY
>16% in Riparian Reserves	10% to 16% in Riparian Reserves	<10% in Rip Res **9%**
0 Mi/Sq Mi Any Rds in Rip Res	0 to 1 Mi/Sq Mi Rds in Rip Res	> 1 Mi/Sq Mi Rd Rip Res **3.71 mi/sq/mi**
< 1 Mi/Sq Mi Open Roads	1 Mi to 2.5 Mi/Sq Mi Roads	> 2.5 Mi/Sq Mi Roads **12.78 mi/sq/mi**
>70% Security Habitat	50% to 70% Security Habitat	<50% Security Habitat **5%**
>10% in Past Burns		<10% in Past Burns **<10%**
>50% Insect/Pathogens (See Disturbance Section in this Chapter)	25% - 50% Insect/Pathogens	< 25% Insect/Pathogens **<25%**
<10% Past CC Harvest **0%**	11% - 25% Past CC Harvest	>25% Past CC Harvest
<10% Past PC Harvest **2%**	11% - 50% Past PC Harvest	>50% Past PC Harvest

(Percentages in bold indicate values for LSR)

(1) Restoration Opportunities And Potential Projects For Snags/Logs

1. Reduce roads in riparian reserves;
2. Retain Snags at High End of Range;
3. Complete snag analysis on 40 acre grid;
4. Monitor for snag dependent species;
5. Increase Security Habitat, reducing overall roading;
6. Reduce Roads in Forest Interior Patches;
7. Manage Insect/Disease at Endemic Levels;
8. Increase Security Habitat; and
9. Monitor for snag longevity in burns

e) Species with Special Status (Plant)

As pointed out above, there are several species with special status with the Deadhorse LSR and Natapoc/Tumwater MLSAs. Following the module in Appendix 1, the first question can not be answered for most of the known species. So, for those not discussed below, projects should be initiated to gather information to answer this question. This would include surveys of species poorly inventoried and population viability estimates (see Gaines et al., in press). Little is known about most species habitat and biologic requirements, and inventories provide a first and necessary step in obtaining this information.

Silene seelyi, Cypripedium fasciculatum, Orobanche pinorum, and *Iliamna longisepala* do not have immediate viability concerns. However, population monitoring should continue, or be initiated, to help develop conservation strategies. A range-wide conservation strategy is being developed by the BLM in Medford, OR, for *C. fasciculatum* and information gathered within the Deadhorse LSR and Tumwater/Natapoc MLSAs should be incorporated into this effort as

appropriate. Climbing areas are or have been established within several of the known *Silene seelyi* populations and monitoring should be directed toward determining trends in population numbers as a result of this recreational activity. A conservation strategy would be important in outlining management of this species. Both *O. pinorum* and *I. longisepala* are relatively abundant and conservation strategies would be important in preventing these species from becoming more rare through management activities.

There are immediate viability concerns for *H. venusta* and these largely result from human activities. This species occurs as both white- and blue-flowered color morphs and is known from only four extant locations. Only one population of the white-flowered form is known and it occurs within the Tumwater MLSA. The species occupies granitic scree slopes with a high degree of surface movement. Highway 2 divides the white-flowered population within Tumwater Canyon and activities associated with highway maintenance have been known to eliminate individuals and suitable habitat at this location. There is a immediate need to develop a conservation strategy and a recovery plan for this species. Introduction and/or augmentation is deemed appropriate in this case.

2. Plant Connectivity

Connectivity can be addressed by analyzing the connectedness of habitats within the LSR. Within the Deadhorse LSR and Natapoc/Tumwater MLSAs, most forest groups are fairly well connected. Many disjunct populations result from inherent breaks or openings in the landscape. At this time, information is not available to complete this type of analysis for nearly all species associate with forest groups within the Deadhorse LSR and Natapoc/Tumwater MLSAs. However, it is noted that suitable habitat for *Iliamna longisepala* could be improved through prescribed burning since this species appears to respond favorably to this disturbance (Kuhlmann and Harrod, unpubl. report). Also, it appears that habitat for *Hackelia venusta* may also be improved through burning (Harrod personal observation). Burning may reduce competition and maintain scree slopes that are important for this species establishment and survival.

3. Wildlife Connectivity

a) Natapoc LSR Wildlife Connectivity

The following is a result of applying the "within LSR/MLSA connectivity assessment process" to the Natapoc LSR.

Table X-14, Connectivity Rankings for Natapoc LSR

Connectivity Variable	Dry	Mesic	MGF	RR	Overall
% Late-success or Fire Climax	L	M	M	M	**M**
Open Road Density	L	L	L	L	**L**
Security Habitat	L	L	L	L	**L**
Forest Interior Roads	L	L	L	L	**L**
% Forest Interior*	L	L	L	L	**L**

Currently, the availability of habitat in a fire-climax condition is low in the dry forests. Restoration projects that promote the development of fire-climax conditions would improve the connectivity in this forest group. The overall open road density and level of security habitat provides for a low level of connectivity in all vegetation types and in riparian reserves. The

current level of forest interior connectivity is considered to be low, as a result of habitat patches being fragmented by roads. This is a concern for species with low mobility. The percent of each vegetation type in a forest interior will improve over time unless a large-scale disturbance occurs. It should be noted that the ranking for this variable may never be high as a result of natural landscape fragmentation. The amount of habitat within a forest interior needs to be evaluated based upon the ecological capabilities of the site and sustainability on a site-specific basis. Site-specific analysis is also necessary to more adequately address connectivity for the less mobile species. This was not adequately addressed at the coarse/moderate filter approach used in this assessment.

(1) Restoration Opportunities

(a) Dry Forest Group

There is an opportunity to improve connectivity within the dry forest vegetation group through the implementation of thinning, prescribed fires, and road closures with associated revegetation.

(b) Mesic Mesic, Moist Grand Fir, and Riparian Reserves

There is an opportunity to improve the connectivity within the mesic and moist grand fir vegetation types, and in the riparian reserves by reducing the level of roads. This may include revegetating road surfaces to provide habitat connectivity for low mobility wildlife species. It may also be possible to use silvicultural methods, such as thinning, to promote the development of late-successional forest structures in forest not currently in a late-successional condition.

b) Deadhorse LSR Wildlife Connectivity

The following is a result of applying the "within LSR/MLSA connectivity assessment process" to the Deadhorse LSR.

Table X-15, Connectivity Rankings for Deadhorse LSR

Connectivity Variable	Dry	Mesic	MGF	RR	Overall
% Late-success or Fire Climax	L	H	M	M	**M**
Open Road Density	H	H	H	L	**H**
Security Habitat	M	M	M	L	**M**
Forest Interior Roads	L	L	L	L	**L**
% Forest Interior*	L	L	L	L	**L**

Currently, the availability of habitat in a fire-climax condition is low in the dry forests. Restoration projects that promote the development of fire-climax conditions would improve the connectivity in this forest group. The overall open road density and level of security habitat provides for a high level of connectivity in all vegetation types. However, in riparian reserves the current road density is 3.6 mi./sq.mi. reducing the connectivity and security of this habitat. The current level of forest interior connectivity is considered to be low, as a result of habitat patches being fragmented by roads. This is a concern for species with low mobility. The percent of each vegetation type in a forest interior will improve over time unless a large-scale disturbance occurs. It should be noted that the ranking for this variable may never be high as a result of natural landscape fragmentation. The amount of habitat within a forest interior needs to be evaluated based upon the ecological capabilities of the site and sustainability on a site-specific basis. Site-specific analysis is also necessary to more adequately address connectivity for the less mobile species. This was not adequately addressed at the coarse/moderate filter approach

used in this assessment. The Wentachee River presents a natural barrier within this LSR for low and some moderate mobility species. In addition, Highway 2 further fragments this LSR for low and some moderate mobility species.

(1) Restoration Opportunities

(a) Dry Forest Group

There is an opportunity to improve connectivity within the dry forest vegetation group through the implementation of thinning, prescribed fires, and road closures with associated revegetation.

(b) Mesic Mesic, Moist Grand Fir, and Riparian Reserves

There is an opportunity to improve the connectivity within the mesic and moist grand fir vegetation types, and in the riparian reserves by reducing the level of roads. This may include revegetating road surfaces to provide habitat connectivity for low mobility wildlife species. It may also be possible to use silvicultural methods, such as thinning, to promote the development of late-successional forest structures in areas not currently in a late-successional condition.

c) Tumwater MLSA Wildlife Connectivity

The following is a result of applying the "within LSR/MLSA connectivity assessment process" to the Tumwater MLSA.

Table X-16, Connectivity Rankings for Tumwater MLSA

Connectivity Variable	Dry	MGF	SAF	RR	Overall
% Late-success or Fire Climax	L	H	L	L	**L**
Open Road Density	M	H	H	L	**H**
Security Habitat	M	H	H	L	**M**
Forest Interior Roads	L	H	H	L	**L**
% Forest Interior*	L	L	L	L	**L**

Currently, the availability of habitat in a fire-climax condition is low in the dry forests. Restoration projects that promote the development of fire-climax conditions would improve the connectivity in this forest group. The overall open road density and level of security habitat provides for a high level of connectivity in all vegetation types. However the current road density within riparian reserves results in a low level of habitat connectivity and security. The current level of forest interior connectivity is considered to be low, as a result of habitat patches being fragmented by roads. This is a concern for species with low mobility. The percent of each vegetation type in a forest interior will improve over time unless a large-scale disturbance occurs. It should be noted that the ranking for this variable may never be high as a result of natural landscape fragmentation. The amount of habitat within a forest interior needs to be evaluated based upon the ecological capabilities of the site and sustainability on a site-specific basis. Site-specific analysis is also necessary to more adequately address connectivity for the less mobile species. This was not adequately addressed at the coarse/moderate filter approach used in this assessment. The Wenatchee River and Highway 2 bisect the Tumwater MLSA. They present a formidable barrier for low and moderate mobility species.

(1) Restoration Opportunities

(a) Dry Forest Group

There is an opportunity to improve connectivity within the dry forest vegetation group through the implementation of thinning, prescribed fires, and road closures with associated revegetation.

(b) Moist Grand Fir, Subalpine Fir and Riparian Reserves

There is an opportunity to improve the connectivity within riparian reserves by reducing the level of roads. This may include revegetating road surfaces to provide habitat connectivity for low mobility wildlife species. It may also be possible to use silvicultural practices, such as thinning, to promote the development of late-successional forest structures in areas not currently in a late-successional condition.

4. Disturbance Risk Analysis

The area encompassed by the Deadhorse LSR and the Natapoc and Tumwater MLSAs contains 23,466 acres, 41% of which is successionally advanced dry or mesic forest. None of the three reserves contain wet forest types. Portions of the area burned with varying intensities during the 1994 fire season. Most of the 2,611 acres designated as "created openings" are the result of those fires. In some instances, salvage logging reduced fuel loads within the burns; where no salvage occurred, the potential for severe soil damage in the event of a reburn is great. Slope steepness would exacerbate such a problem by delivering the loose, unprotected soils into stream and river channels. Increased mortality from Douglas-fir beetles can be expected within and adjacent to areas burned in the 1994 fires. This mortality will likely continue for 4 years following the fire. Evidence from other areas in the Inland West suggest the possibility that mortality levels from Douglas-fir beetles will continue for up to 6 post-fire years in areas adjacent to the burn that contain large Douglas-firs infected with root disease. Such mortality will greatly augment the supply of high-quality snags.

The many roads within these reserves elevates risk of human ignitions. Dry, successionally-advanced forests on steep slopes allow fires to spread. The rugged terrain inhibits fire suppression activities.

Insect activity within these reserves has and continues to be relatively high. A prolonged drought during the 1980s created conditions that sustained outbreaks of fir engraver. During the 1970s, many acres within these reserves sustained damage from both Douglas-fir tussock moth and western spruce budworm. Portions of these reserves were sprayed for western spruce budworm during the 1970s.

The following information on insect activity in the three reserves is from data collected during the aerial surveys conducted by Region 6 Insect and Disease Group. Light infestations or damage on less than 100 acres are not reported.

- Mountain pine beetle (lodgepole): 1950-51, 1958
- Mountain pine beetle (western white pine): 1952-53, 1958, 1969, 1971, 1976, 1981-82, 1986, 1989, 1991
- Mountain pine beetle (ponderosa): 1978-79, 1983, 1988-90,
- Western pine beetle: 1978, 1982, 1986-87, 1994
- Fir sawfly (true fir): 1953
- Fir engraver: 1982, 1986, 1988-91 (heavy),
- Douglas-fir beetle: 1954, 1958, 1976, 1988, 1993,
- Western spruce budworm: 1972-77, 1979
- Douglas-fir tussock moth: 1972

Susceptibility of the Deadhorse LSR and Natapok and Tumwater MLSAs to fires, insects, and pathogens is shown in the table below. Mortality from biotic disturbance agents will be greatest where host continuity across the landscape is high and where there is overlapping moderate to high risk among two or more disturbance agents that act synergistically. Risk associated with biotic disturbance agents generally elevates the risk of catastrophic fires by potentially increasing fuel levels; this is especially true in the dry forest vegetation group and in vegetation upslope from or surrounded by dry forests.

Table X-17, Disturbance Matrix, Deadhorse LSR / Natapoc MLSA / Tumwater MLSA

Veg Type	Fire	Dwarf Mistletoe	Root Disease							Total
		DF	AROS	HEAN	PHWE	WPB	WSB	DFB	FE	
10	M	M	M	L	L	L	L	H	-	M
11	M	M	M	L	L	M	M	M	-	M
12	H	H	M	L	M	H	H	M	-	H
13	H	H	M	L	M	M	H	M	-	H
20	M	M	M	M	M	L	L	H	M	M
21	H	M	M	M	M	L	M	M	M	H
22	H	H	M	M	M	L	H	H	M	H
30	M	M	M	M	M	L	L	H	M	M
31	H	M	M	M	M	L	L	M	M	H
32	H	H	M	M	H	L	M	M	M	H
33	H	H	M	M	H	L	M	M	H	H
40	L	L	L	L	L	-	L	L	L	L
50	L	L	L	L	L	-	L	L	L	L
52	M	L	L	L	L	-	L	L	L	M

Key to Column Headings: PP = Ponderosa Pine, DF = Douglas-fir, WL = Western Larch, PIPO = Ponderosa Pine; PSME = Douglas-fir; LAOC = Western Larch; AROS = Armillaria root disease; HEAN = Annosus root disease; WPBR = White Pine Blister Rust; WSB = Western Spruce Budworm; DFB = Douglas-fir Beetle; MPB = Mountain Pine Beetle; WPB = Western Pine Beetle.

Key to Letters "-" = no risk; "L" = low risk, "M" = moderate risk, "H" = high risk

Veg Type codes: refer to Appendix 3, in the "Forest-wide Assessment for Late Successional Reserves and Managed Late Successional Areas, Wenatchee National Forest".

Areas that were lightly or moderately burned during the 1994 fire season provide opportunities for the reintroduction of fire to maintain open stands of large ponderosa pine. In some instances, fuel levels have been reduced enough for prescribed fires to be a feasible means of maintaining these stands within historic ranges of variability. In other instances, dead fuel levels must be reduced before prescribed fires can be safely used. In stands that did not burn during 1994, there are opportunities for commercial and pre-commercial thinning to reduce vertical and horizontal fuel loads and to restore stands in successionally-advanced dry forest to sustainable vegetation conditions. Adequate average canopy cover can be maintained in dry stands by alternating clumps of trees with more open areas. Because of the high road densities, fuelwood cutting may be used to reduce amounts of dead and dying trees. Care must be taken when operating near riparian reserves as these reserves contain important salmonid populations.

5. Northern Spotted Owl

The following is the discussion and results of the within LSR/MLSA Spotted Owl Module for the Deadhorse LSR, the Tumwater and Natapoc MLSAs. This module reviews the home range sites for spotted owls, as well as connectivity within the LSR/MLSAs. Appendix 1 further describes the order, explanations and process of modules, specifically the Northern Spotted Owl Module, Individual LSR/MLSA. See Suitable Spotted Owl/Dispersal Habitat and Activity Center map and tables, Forest Interior Map and tables, Riparian Reserve map and tables and Security Habitat map and tables.

The recovery of the federally Threatened northern spotted owl is highlighted in management strategies within LSRs and MLSAs (See appendix 1 - Northern Spotted Owl Module, Individual LSR/MLSA). This includes:

- LSRs and MLSAs will meet the goals for the numbers of owl pairs within each LSR or MLSA (NWFP 1994 B-4; NWFP C-9; FSEIS Appendix G, Biological Opinion, 1994; USDI. 1992. Northern Spotted Owl Recovery Plan, and USFWS Memorandum, 1991);
- Each spotted owl's 100 acre Activity Center will have the best quality habitat established and retained;
- Each spotted owl's 500 acre Core Area will have the best quality habitat and habitat will be retained;
- Each spotted owl home range will meet threshold acreage's (2,663 acres) as a minimum. Wetter owl sites in LSRs well meet target or optimal habitat of 3,994 acres.;
- Sustainable, suitable spotted owl habitat outside home ranges will be maintained ;
- Dispersal habitat within and outside LSR/MLSA will be provided; (NWFP 1994, ROD pg. 19, C-3, C-10 to 11, C-39, C-45, D-9, App 3-4, pg. 240-241).
- Habitat conditions for long-term (> 50 years) sustainable nesting/roosting/foraging habitat will be improved (see DECs and DCs in Forest-wide document, Chapter III PP 87-95); and
- The risk of habitat loss and nest site loss will be reduced (NWFP 1994, C-12 to 16, C-26);

The Deadhorse LSR has 7 activity centers for spotted owls, there are two main cluster groups for these owls. One group is in the Deadhorse/Skinney areas, the other group is in the Wenatchee Bowl/Sunitsch area. Clusters of owls provide better function for LSR and species recovery, than do isolated owl sites.

The Deadhorse LSR includes approximately 20% private lands. The Tumwater MLSA is approximately 30% in private ownership. And the Natapoc MLSA is approximately 25% on private lands. Combined, the LSR/MLSAs are mostly in the dry forest groups (52%-66%). Only 1 spotted owl pair is in the wetter forest groups, the other 7 sites are in the drier forest groups. Four spotted owl pairs are in dry forest habitats, three are in mesic and one is in moist. Spotted owl home ranges overlap outside the LSR/MLSAs onto Matrix and private land habitat. Home ranges are based on 1.8 mile radius circles, each owl site should be reviewed for actual home ranges, often linear/oblong along north aspects and riparian forest stringers. The Desired Condition for spotted owl habitat in dry LSRs and all MLSAs is 40% of the 1.8 mile home range radius, which is 2,663 acres (see description of habitat in DECs, Chapter VII page 92-95). These

drier forest LSR and all MLSAs will be accept less risk and hazard reduction than do wetter LSRs.

a) Suitable Spotted Owl Habitat

(1) Deadhorse LSR

The amount of spotted owl nesting/roosting/foraging habitat within the Deadhorse LSR is 6,692 acres (37% of the LSR). Of this, 1,549 acres (8%) are in moist forests. The moist spotted owl habitat has a higher chance of sustainability, than dry and mesic forest groups. The LSRs predominate forest vegetation is dry (11,994 acres 65% LSR), of which 3,210 acres is N/R/F spotted owl habitat. In additional there are moist and mesic forest suitable habitat.

There is a potential for the LSR to reach 11,044 acres (60% LSR) of suitable habitat. Conceptually, this potential habitat could support 4+ pairs of spotted owls. However, most of this potential habitat is in the drier/mesic forest groups, and not likely to be sustainable. The goal for this LSR is 4+ pairs of spotted owls. Sustainable spotted owl habitat within this LSR is approximately 2,391 acres of moist forest group habitat. It is doubtful that 4+ pairs of spotted owls can be sustained in this LSR over the long-term (> 50 years). The most contiguous and sustainable suitable spotted owl habitat in the LSR is in the Wenatchee River bowl, the northwest portion in upper Deadhorse, as well as fire refugia on north aspects.

Dispersal habitat currently is quite high at 8,424 acres (46%), and is a mix of dry, mesic and moist forest groups. (See appendix 13 Suitable Habitat Acreage's, appendix 4 & 5 Vegetation Acreage's, and Suitable Spotted Owl Habitat Maps).

There are 7 spotted owl activity centers: all but 1 are on drier habitats. Habitat analysis for the Deadhorse LSR, as well as Tumwater and Natapoc MLSAs are based on vegetation mapping, and a model of spotted owl habitat structure. The map and acreage's should be validated prior to project implementation.

Some spotted owl habitat was lost to fire in 1994 Hatchery Creek fire. Further disruption to spotted owl habitat, inside and outside the LSR, is the fire risk on dry forests, especially in the heavily populated areas in dense dry forests (the Chumstick Valley). Other potential disruptions are the private land fragmentation and development. To meet the recovery goals for the spotted owl, there is a need to increase/accelerate spotted owl dispersal habitat within the spotted owl core area and home range. Coordination with private land owners and the DNR is important for the Deadhorse LSR.

From a Forest-wide perspective, there are 5 LSR/MLSAs that may not provide spotted owl connectivity and sustainability over time: Sand MLSA, Swauk LSR, Boundary Butte LSR, Deadhorse LSR, and Shady Pass LSR (see Appendix 1, "Forest Wide Spotted Owl Module" and "Individual LSR/MLSA Spotted Owl Module", Table 2, "Spotted Owl Habitat, and Sustainable Habitat in LSRs/MLSAs" and Table 3 "Summary LSR/MLSA Status & Spotted Owl Pairs Existing and Sustainable on the Forest"). LSR/MLSA spotted owl connectivity and sustainability was analyzed individually and collectively. The Critical Habitat Units were compared with LSRs and MLSAs, to determine if the reserves meet the intent of the CHU needs (connectivity, home range goals, juxtaposition, and range-wide distribution). The existing condition was then compared to the sustainable habitat conditions, for long term spotted owl habitat.

It is recognized that the LSR/MLSAs were designed with the intent that habitat may be lost due to fire or other disturbances, while other LSR/MLSAs will increase in spotted owl habitat as late successional habitat is recovered. However, some LSR/MLSAs are in strategic locations for dispersal, connectivity, genetic interchange. Overtime, there is some question of sustainability of

spotted owl habitat in 5 of the 27 LSR/MLSAs. The need is a long-term (>50 years) support for connectivity and home range goals for spotted owls in these LSR/MLSAs and across the province. The sustainability question is due to the amount of dry and mesic forested habitat at risk to fires in these 5 LSR/MLSAs. To strengthen connectivity, home ranges and spotted owl viability, the reserve boundaries could be expanded to include wetter forest and spotted owl home ranges in areas of important connectivity. LSR or MLSA boundary extensions in reserves important for spotted owl connectivity (but low in sustainability) include: Sand MLSA (wetter habitat to the south, including spotted owls inside the CHU WA-12); Swauk LSR (wetter habitat to the north, see Forest-wide spotted owl module); Boundary Butte LSR (wetter habitat to the south, including spotted owls inside the CHU WA-11); Deadhorse LSR (all available wetter habitat is included in the LSR and CHU WA-9, monitor this reserve, no boundary changes are recommended); and Shady Pass LSR (habitat to the southeast in the Twenty-five Mile Creek CHU WA-4).

(2) Tumwater MLSA

The amount of nesting/roosting/foraging habitat within the Tumwater MLSA is 662 acres (16% of the MLSA). Of this, 464 acres (11%) are in moist forests. Moist habitat has a better chance of long-term sustainbility than does dry or mesic habitat. There are no acres in wet forests. The MLSAs predominate forest vegetation is dry (2,134 acres -- 52% MLSA), of which 313 acres is N/R/F spotted owl habitat. There are small amounts of mesic and subalpine fir forested groups in this MLSA.

There is a potential for the MLSA to reach 1,188 acres (29% MLSA) of suitable habitat. Conceptually, this potential habitat could support less than 1 pair of spotted owls. There are 724 acres of potential habitat is in the dry/mesic forest group, and not likely sustainable. There are 466 acres sustainable spotted owl habitat within this MLSA, with the possible additions of fire refugia areas on north aspects or stream bottoms. As a result of the 1994 fires (and 1993 fires), the only spotted owl pair in this MLSA has had a great reduction of habitat. It is doubtful that any pairs of spotted owls can be sustained in this MLSA over the long-term (> 50 years). The most contiguous and sustainable suitable spotted owl habitat in the MLSA is to the east on Tumwater Mountain, as well as north aspects.

Dispersal habitat currently is 1,029 acres (25%), and is primarily dry forest group. (See appendix 13 Suitable Habitat Acreage's, appendix 4 & 5 Vegetation Acreage's, and Suitable Spotted Owl Habitat Maps).

This LSR/MLSA is part of the reserves that are predicted to provide the needs for spotted owl recovery over time (50+ years). Coupled with the LSR/MLSA management, riparian reserve function, Wilderness areas, and Unmapped LSRs, the needs of the spotted owl will be met. The reserves function for connectivity and spotted owl home ranges. With the exception of a few LSR/MLSAs that are not sustainable, it is concluded that the LSR/MLSA reserves on the Wenatchee National Forest meet the function of the CHU system, as intended in the NWFP (NWFP C-9). Monitoring and maintaining connections, as well as meeting LSR goals will be ongoing. (See Appendix 1, "Forest-wide Spotted Owl Module" and "Individual LSR/MLSA Spotted Owl Module")

(3) Natapoc MLSA

The amount of nesting/roosting/foraging habitat within the Natapoc MLSA is 462 acres (43% of the MLSA). Of this, 51 acres (5%) is in moist forests and 117 acres (11%) are in mesic forests. There are no acres in wet forests. The MLSAs predominate forest vegetation is dry (706 acres -- 66%), of which 294 acres is N/R/F spotted owl habitat.

There is a potential for the MLSA to reach 828 acres (77% MLSA) of suitable habitat. There is 732 acres of potential habitat in the dry/mesic forest group, but not likely sustainable. There are 96 acres sustainable spotted owl habitat within this MLSA, with the possible additions of fire refugia areas on north aspects or stream bottoms. It is doubtful that any pairs of spotted owls can be sustained in this MLSA over the long-term (> 50 years). Habitat adjacent in the Deadhorse LSR is important for the function of the Natapoc MLSA and the Deadhorse LSR. The most contiguous and sustainable suitable spotted owl habitat in the MLSA is to the west on Natapoc Mountain, as well as north aspects.

Dispersal habitat currently is 568 acres (53%), and is primarily dry and mesic forest groups. (See appendix 13 Suitable Habitat Acreage's, appendix 4 & 5 Vegetation Acreage's, and Suitable Spotted Owl Habitat Maps).

This LSR/MLSA is part of the reserves that are predicted to provide the needs for spotted owl recovery over time (50+ years). Coupled with the LSR/MLSA management, riparian reserve function, Wilderness areas, and Unmapped LSRs, the needs of the spotted owl will be met. The reserves function for connectivity and spotted owl home ranges. With the exception of a few LSR/MLSAs that are not sustainable, it is concluded that the LSR/MLSA reserves on the Wenatchee National Forest meet the function of the CHU system, as intended in the NWFP (NWFP C-9). Monitoring and maintaining connections, as well as meeting LSR goals will be ongoing. (See Appendix 1, "Forest-wide Spotted Owl Module" and "Individual LSR/MLSA Spotted Owl Module")

b) Spotted Owl Home Ranges

Within the Deadhorse LSR, Tumwater and Natapoc MLSAs, the estimated amount of habitat within a 1.8 mile radius of the activity center is shown in the table below. All spotted owl home ranges are below threshold acres. One spotted owl site (SO703) is below threshold only in the core area of 0.7 miles radius (>500 acres). Most of these owls are low both in the core and the home ranges of 1.8 miles radius (>2,663 acres).

The Deadhorse/Tumwater/Natapoc spotted owls will need dry and mesic forest to make up their threshold home ranges. In addition, there is a need for cooperation between DNR and private land owners, for risk reduction, and habitat improvement to reach and maintain threshold acreage. Dispersal acres may be used for threshold habitat. Dispersal habitat in the wet, moist, mesic may be accelerated towards late successional structure and size. All spotted owl sites should be monitored and habitat verified. Of note, to reach 2,663 acres habitat on 7 of the 8 sites, acreage outside the LSR/MLSA is needed. Owl SO720 is totally within the LSR. The DNR Section 16, on the north of the Deadhorse LSR, appears to have suitable habitat in mesic and dry forest groups.

For long-term population viability, there is some potential to reduce risk of hazard and to restore sustainable habitat in cut over areas. There is also a need to protect existing habitat and home ranges, especially in sites below threshold and target acreage's (see Table ??? Suitable Spotted Owl habitat). This will cause a higher risk to fire in the dry forest habitat maintained for the spotted owl. Overtime, it is expected that higher quality and more sustainable habitat will be restored to the LSR/MLSA and to the nearby Chiwawa LSR. The drier forests within the LSR/MLSA will eventually be managed for other late-successional species.

Table X-18, Suitable Spotted Owl Habitat, Deadhorse LSR, Tumwater MLSA, Natapoc MLSA

	SUITABLE SPOTTED OWL HABITAT[10]	Restore

	1.8 mile Circle Around Activity Center				0.7 mile Circle Around Activity Center				.33 mile Circle Around Activity Center[11]				Opps & Priority
DEAD-HORSE Spotted owl	**Dry**	**Mesic**	**Wet-ter**	**Total**	**Dry**	**Mesic**	**Wet-ter**	**Total**	**Dry**	**Mesic**	**Wet-ter**	**Total**	* & #
SO703 Thompson	366	573	1,785	**2,724**	70	0	358	**428**	17	0	93	**111**	**m,a,c,p #1**
SO715 Deadhorse	1068	820	739	**2,627**	231	165	60	**455**	52	46	0	**98**	**m,a,p,c #2**
SO720 Up Sprom	1146	397	0	**1,542 Burn**	182	29	0	**211**	53	0	0	**53**	**m,p,a,c #7**
SO721[1] Lo Sprom	1024	0	0	**1,024 Burn**	288	0	0	**288**	82	0	0	**82**	**m,c,p #9**
SO725 Sun/Sprom	1388	506	0	**1,894**	296	8	0	**303**	77	0	0	**77**	**m,a,p,c #5**
SO726 Wright Cny	1279	1258	1	**2,538**	44	475	0	**519**	0	155	0	**155**	**m,a,c,p #3**
SO727 Wen Bowl	1399	1080	0	**2,480**	136	352	0	**488**	29	58	0	**87**	**m,a,c,p #4**
SO744 Circle S	1363	438	0	**1,801**	290	2	0	**292**	91	0	0	**91**	**m,c,a,p #6**
Historic s.owls													
SO762 Skin/Tunnel	973	649	1141	2,763	142	114	206	463	10	18	98	126	**m,p #10**
Spotted Owl TUM-WATER	**Dry**	**Mesic**	**Wet-ter**	**Total**	**Dry**	**Mesic**	**Wet-ter**	**Total**	**Dry**	**Mesic**	**Wet-ter**	**Total**	* & #
SO722 Jolanda	333	17	576	**926 Burn**	61	0	0	**61**	27	0	0	**27**	**m,p,a,c #8**
Spotted Owl NATA-POC	**Dry**	**Mesic**	**Wet-ter**	**Total**	**Dry**	**Mesic**	**Wet-ter**	**Total**	**Dry**	**Mesic**	**Wet-ter**	**Total**	* & #
SO640 Natapoc Mtn Historic s.owls				--				--				--	**m #11**

Below Threshold: < 2,663 ac suitable spotted owl habitat in 1.8 mi circle **OR** < 500 ac suitable spotted owl habitat in 0.7 mi circle.

At Threshold: 2,663-3,994 total suitable spotted owl habitat acres in 1.8 mile circle.

Optimum/Target: > **3,994** total suitable spotted owl habitat acres in 1.8 mile circle.

[10] **Dry suitable spotted owl habitat** includes vegetation code 12 where size/structure is multistory greater than 9" DBH;

mesic includes code 22; and

wet includes codes 32, 36, 62, 64, and 42.

* **Restoration Opportunities**: **M** = Monitor Habitat & Site; **P** = Protect Habitat From Reduction or From Risk; **A** = Accelerate Habitat Towards Nesting, roosting, Foraging; **C** = Coordinate Habitat and Site Management, or Acquire Habitat.

Priority Number for LSR/MLSA Management Actions.

c) Spotted Owl Dispersal And Connectivity

The combined Deadhorse LSR and Tumwater/Natapoc MLSA have a total of 8 spotted owl activity centers. There is potential for at most, 5 spotted owl pairs to occur on site; however, spotted owl habitat sustainability is low in the LSR/MLSA. Connectivity within the LSR/MLSA is based on foraging and dispersal opportunities. Important connectivity habitat exists along the Wenatchee River bowl, Deadhorse/Natapoc area, north aspects of Spromberg/Sunitsch, and Tumwater Mountain area. There is some good quality habitat between Deadhorse. Skinney, Natapoc, Wenatchee River bowl. Habitat in the Spromberg and Tumwater areas are lower quality.

Important connectivity corridors and patches between LSRs/MLSAs include: from Natapoc to Beaver Creek into the Chiwawa LSR; from the Deadhorse to Chiwaukum Creek and Cabin Creek into the Icicle LSR; from the Deadhorse through upper Coulter Creek to Whitepine into the Little Wenatchee LSR; and on into LSRs on the west-side of the Cascade Crest. An important linkage may have been disrupted in the 1994 fires, and no longer functions from Tumwater MLSA to Boundary Butte LSR and from Boundary Butte to Icicle LSR.

During dispersal - nesting, roosting, foraging habitat is used, as well as habitat of lower quality (dispersal habitat). Dispersal habitat includes single story stands, and smaller trees with at least 40% crown closure. This dispersal habitat could be prioritized for thinnings (to increase late-successional quality), or to add into below threshold home ranges, or to reduce risk of fire hazard if dry or mesic. Dispersal habitat within the Deadhorse LSR is 8,424 acres (46%), Tumwater MLSA is 1,029 acres (25%) and for Natapoc MLSA is 568 acres (53%). Dispersal habitat can grow up to be nesting/roosting/foraging habitat. Habitat providing dispersal/connectivity corridors within the LSR/MLSA are primarily along riparian reserves and north aspects (see Forest Interior map and Suitable Spotted Owl Habitat Map).

The function of dispersal/connectivity habitat for spotted owls depends on the amount and juxtaposition of late-successional, forest interior, and dispersal habitat. The Deadhorse LSR currently has 54% (9,843 acres) in late-successional/successionally advanced. Of that late-successional forest, 1,521 acres are in wetter forest habitat. Tumwater MLSA has 26% (1,079 acres) late-successional/successionally advanced forest. There is 332 acres of wetter forest habitat. Natapoc MLSA has 63% (671 acres) in late-successionally/successional advanced forest. Most of the Natapoc is dry, there is some mesic and some moist. The vegetation mapping has not been field verified, the forest groups should be validated.

There is a low amount of forest interior habitat in these LSR/MLSAs, averaging 2% for the 3 areas. There are 5 spotted owl activity centers located on/near forest-interior patches, demonstrating the importance of forest interior for wildlife species. The natural landscape accounts for much of the disruption to Forest Interior habitat. There is a moderate amount of fragmentation from past harvest (15% over all three areas, more on adjacent private land).

The low road densities of Deadhorse/Tumwater (Deadhorse LSR 0.80 miles per square mile, and Tumwater MLSA 0.52 miles per square mile) and moderate Security Habitat (57% Deadhorse LSR and 59% Tumwater MLSA) have a lower effect on connectivity. The Natapoc MLSA has higher road densities, but is skewed, due to the smaller size of the MLSA. The Natapoc MLSA has higher road densities (3.71 miles per square mile), and lower security habitat (5%). Higher road densities and lower security habitat shows that fragmentation usually occurs along roads, and snag reductions for road maintenance cumulatively effects habitat overtime.

Outside the LSR/MLSA network, dispersal habitat is found in all land allocations, and will be provided mainly in Riparian Reserves, in Unmapped LSRs in Matrix/AMA's, and in wilderness areas (NWFP 1994, ROD pg 19, C-3, C-10 to 11, C-39, C-45, D-9, App 3-4, pg. 240-241).

In all LSR/MLSAs, except the Swauk LSR, Shady Pass LSR, Deadhorse LSR, Boundary Butte LSR, Tumwater MLSA and Sand MLSA, these reserves are predicted to provide the needs for spotted owl recovery over time (50+ years). They will also provide the function the CHUs were designated for. Coupled with the LSR/MLSA management, riparian reserve function, Wilderness areas, and Unmapped LSRs, the needs of the spotted owl will be met. These reserves function for connectivity and spotted owl home ranges. It is concluded that the LSR/MLSAs meet the function of the CHU system, as intended in the NWFP (NWFP C-9). Monitoring and maintaining connections, as well as meeting LSR goals will be ongoing.

d) Restoration Opportunities And Potential Projects - Within LSR/MLSA

- **MONITOR EFFECTIVENESS**

1. Meet LSR/MLSA goals for spotted owls (Deadhorse 4+, Tumwater 1, Natapoc area 1).
2. Monitor spotted owl activity centers and 500 acre core. Prioritize sites below threshold first.
3. Monitor historical spotted owl sites SO762 and SO640.

- **MONITOR VALIDITY**

4. Monitor potential of LSR/MLSAs to support 6+ pairs, when combined.
5. Validate assumption that Deadhorse LSR and Tumwater/Natapoc MLSAs can not support many pairs of owls.
6. Validate spotted owl mapping, LSR acreage's, home range acreage's, and 500 acre core. Field verify habitat and activity center locations.
7. Validate vegetation mapping for forest groups. Field verify.
8. Reconfigure spotted owl habitat home range, based on foraging pattern, rather than 1.8 mile circle. Suspect owl moves through moist/linear habitats rather than circular lower quality. Use the best quality of habitat available.

- **MONITOR IMPLEMENTATION**

9. Each spotted owl 100 acre Activity Center will have the best quality habitat, and will be retained.
10. Each 500 acre Core Area will have the best quality habitat, and will not be reduced (habitat will be retained).

11. Each spotted owl home range will meet threshold acreage's (2,663 acres) as a minimum. Wetter LSRs well meet target or optimal habitat of 3,994 acres.
12. During management proposals, use habitat quality/risk assessment analysis (Appendix 29) to help display best quality habitats and stands of highest risk to loss.

- **PROTECTION**

13. Protect spotted owl home ranges, and connectivity between owl circles within LSR/MLSA.
14. Implement risk reduction first on non-suitable habitat, then on dispersal habitat, then on Dry and Mesic N/R/F habitat.
15. Sustain spotted owl habitat inside LSR/MLSA in north aspects, riparian reserves.
16. Maintain dispersal/connectivity habitat and connectivity outside LSR/MLSAs towards Icicle, Little Wenatchee, and Chiwawa LSRs.
17. Protect and/or create connectivity outside LSR/MLSA towards Boundary Butte and Eagle LSRs.
18. Maintain dispersal/connectivity habitat (see unique habitats list).

- **HABITAT IMPROVEMENT**

19. Habitat conditions for long-term (> 50 years) sustainable nesting/roosting/foraging habitat will be improved (see DECs and DCs in Chapter VII, Forest-wide Assessment).
20. Accelerate Dispersal Habitat to N/R/F around owl sites needed to reach threshold.
21. Improve and accelerate N/R/F habitat, primarily in wet/moist forest groups, to maintain number of spotted owl pairs. Accelerate dispersal habitat and old plantations.
    - Clear cuts in wet/moist vegetation groups predicted to be habitat in 100 years.
    - Clearcuts in mesic/dry vegetation groups will be habitat in 120 years.
    - Pole sized stands in wet/moist will be habitat in 50 years.
    - Pole sized stands in mesic/dry will be habitat in 70 years.
22. The risk of habitat loss and nest site loss will be reduced.
23. Fuels reduction and hazard reduction occur outside N/R/F habitat in short term, shift emphasis in 50 years. Accept more risk from fire, manage at high end of spotted owl habitat DC. Spotted owl habitat maintained at 40% of home range, 500 Acre core area protected, 100 acre activity center protected.
24. Aggressive protection of dry N/R/F suitable spotted owl habitat near activity centers as noted in Table X-18, Suitable Spotted Owl Habitat, Deadhorse LSR, Tumwater MLSA, Natapoc MLSA on page 411.
25. Increase habitat effectiveness and connectivity by reducing open roads and revegetating road beds. Especially in forest interior habitat patches.

- **COORDINATE**

26. Cooperate and encourage DNR and private landowners to manage identified sites for owls.

27. Consider LSR boundary adjustment to add into the Deadhorse LSR the newly exchanged lands along the Wenatchee River, Sec 35. Adding habitat for owls SO725, SO726, SO727, S0744.

28. Acquire habitat from Private Lands for n/r/f around target owl sites, to reach threshold acres.

- **OTHER**

29. To strengthen connectivity, home ranges and spotted owl viability, expand the reserve boundary to include wetter forest and spotted owl home ranges in areas of important connectivity:

    - Sand MLSA (wetter habitat to the south, including spotted owls inside the CHU WA-12);
    - Swauk LSR (wetter habitat to the north, see Forest-wide spotted owl module);
    - Boundary Butte LSR (wetter habitat to the south, including spotted owls inside the CHU WA-11);
    - Deadhorse LSR (all available wetter habitat is included in the LSR and CHU WA-9, monitor this reserve, no boundary changes are recommended);
    - Shady Pass LSR (habitat to the southeast in the Twenty-five Mile Creek CHU WA-4).

6. Aquatic

The Tumwater MLSA, Natapoc MLSA, and Deadhorse LSR (Tumwater/Natapoc/Deadhorse) are located in the upper Wenatchee River and Chumstick drainages. The upper Wenatchee River provides very important summer chinook salmon, spring chinook salmon, summer steelhead and bull trout habitat. Chumstick is a small drainage tributary to the upper Wenatchee. Aquatic species populations within the Chumstick have been impacted by human settlement and a migration barrier. The lands included in this assessment lie between the outlet of Lake Wenatchee and the town of Leavenworth.

a) Geomorphology

Tumwater/Natapoc/Deadhorse areas are located in a transition between the Wenatchee Highlands Subsection and the Wenatchee Swauk Sandstone Hills Subsection. The Tumwater MLSA is located in Tumwater Canyon. The Tumwater Canyon area truly represents a transition between the glacial landscapes associated with the Wenatchee Highlands and the non-glaciated sandstone of the Wenatchee Swauk Sandstone Hills. The predominate landform in Tumwater Canyon is the Glaciated Mountain Slope. Unlike the Glacial Trough landforms, the alpine glaciers road over these landforms modifying the slopes but not creating the extreme topographic expressions of cirques and trough walls. Shallow soils and exposed bedrock have poor water holding capacity thus runoff is rapid. The rapid runoff in steep first order drainages could result in efficient sediment delivery but a paucity of first order drainages reduces overall sediment delivery potential. Stream erosion through till material on the valley floor is a significant source of natural sediment. Where till material is plastered on valley slopes in association with incised drainages debris flows and snow avalanches can be important sources of coarse and fine sediment, and organic material to stream channels.

The Deadhorse and Natapoc areas are predominately within the Wenatchee Swauk Sandstone Subsection. The Swauk Sandstone and Chumstick Sandstone geologic formations dominate this

subsection. The geomorphology is strongly influenced by folded, inter-bedded bedrock with dipslope/scarpslopes forming narrow, confined v-shaped valleys, resulting in highly dissected landforms. Surface erosion is the predominate erosion process with occasional mass wasting associated with the weaker, incompetent beds. These landforms lie within the rain shadow of the crest of the Cascade Mountains thus are generally dry landscapes. The poor water holding capacity of the soil and dry climate results in soil moisture stress except in some higher elevation areas, or in relatively high precipitation areas.

The watersheds have numerous first-order drainages many of which are ephemeral. Due to the poor soil moisture capacity, precipitation runs-off the slopes rapidly through the dense first-order drainage network. Flows are flashy with steep peaks rapidly dropping to baseflow levels after storm events or snow runoff. With little near surface ground water, base flows can be very low compared with other areas on the Forest . The low summer flows and hot, dry summers create the potential for high stream temperatures. The dry landscape adds extra importance to riparian habitat associated with perennial streams and springs.

The numerous first-order tributaries within these fine-grained, erosive soils create watersheds with efficient downstream fine-sediment delivery. These landscapes are actively eroding. Natural events such as fire and/or high intensity rains, or management activities which remove the little soil protection offered by organic matter may greatly accelerate erosion. Summer thunderstorms may trigger flashfloods and mud flows. The streams are actively degrading (downcutting) through the fine textured material. Mainstem channels are often associated with multiple terraces of recent origin.

Much of the Wenatchee Swauk Sandstone Hills, especially the lower elevations naturally experienced a high frequency, low intensity fire regime. Management actions such as fire suppression and selective timber harvest have changed much of the area to an unnaturally high intensity fire regime. When fires now occur followed by high intensity precipitation an accelerated rate of erosion may occur. It is also possible that summer low flows may be reduced due to the higher than natural amount of coniferous vegetation.

There is a small amount of Floodplain Response Landtype mainly associated with the Wenatchee River The Floodplain Response landtypes have high water tables, broad riparian zones and bank erosion is common as streams migrate across the flood plain (Dawson and others 1996) The presence of water with a frequent disturbance interval due to flooding and subsequent bank erosion, combined with the deposit of debris flow material creates a diverse riparian habitat. These landforms produce a diverse aquatic habitat and are important to many of the salmonids. Bank erosion is an important mechanism for delivery of coarse and fine sediment and organic material to streams. Naturally, streams meander across these floodplains through time except where large debris fans constrain the channels (Dawson and others 1996)

(1) Management Concerns due to Geomorphology

In the Wenatchee Swauk Sandstone Hills management needs to recognize that erosive soils combined with numerous first order channels create an efficient delivery system for fine sediment. Fires which consume much of the organic material may also accelerate surface erosion. High intensity precipitation events may result in large pulses of fine sediment through surface erosion or mud/debris flows.

Given the rapid runoff characteristics and soil moisture stress, management actions need to prevent accelerated surface erosion, minimize the interception and concentration of flows on roads which may accelerate water delivery to stream channels. Management of riparian areas for aquatic resources needs to focus on; maintaining bank stability given the rapid downcutting

observed in these streams, providing a filter for fine sediment, providing shade to ameliorate high summer water temperatures and possible insulation against low winter temperatures. Given the lack of water within the subsection other than that associated with the few perennial streams and springs, riparian vegetation and the associated microclimate may be very important to amphibians and other wildlife.

The principal management concern in the Glaciated Mountain landform is the occurrence of debris and snow avalanches. Careful road location is required to avoid susceptible areas. Within the Floodplain Response landform riparian reserves may need to be relatively wide to allow for channel migration across broad floodplains.

b) Upper Wenatchee River

The Tumwater/Deadhorse/Natapoc areas include lands draining into and adjacent to the mainstem Wenatchee River, from near the outlet of Lake Wenatchee through Tumwater Canyon near the town of Leavenworth. The upper Wenatchee River provides extremely important fish habitat. This stretch of the river provides summer chinook spawning habitat, summer steelhead and spring chinook salmon rearing habitat, and bull trout habitat. A portion of the upper Wenatchee River is designated as a Key Watershed in the Northwest Forest Plan. The Tumwater/Deadhorse/Natapoc LSRs encompass lands within six subwatersheds that include or are adjacent to the mainstem Wenatchee River; Skinny, Upper Wenatchee, Chiwaukum, Tumwater Cabin-Fall, Middle Wenatchee.

Table X-19, Key Salmon Status by Wenatchee Watershed subwatershed

subwatershed	Bull	Soc	Cut	Red	Steel	Spc	SuC
Skinny	U	A	U	P	U	U	A
Upper Wen	P	P	P	P	P	P	Ps
Chiwaukum	P	A	P	Ps	P	P	A
Tumwater	P	P	P	P	Ps	P	Ps
Cabin-Fall	U	A	U	P	U	A	A
Middle Wen	U	P	P	P	P	P	Ps

soc = sockeye, Cut = westslope cutthroat, Red = redband trout, Steel = steelhead, SPC = spring chinook, SuC= summer chinook. P = Present, A = Absent, U = unknown, s = significant

Both the western pearlshell and western floater mussel have been found in the upper Wenatchee River (Stock 1995)

(1) Skinney subwatershed

Skinney Creek and Thompson Creek are two small drainages tributary to the Wenatchee River. The streams head near Winton and flow in an easterly direction before reaching a small valley bottom in a Floodplain Response landtype. This Floodplain Response landtype is the result of fine material deposited behind an ancient glacial dam. Upon reaching the valley floor Thompson Creek joins Skinney Creek and the streams flow south through a series of beaver dams. Skinney Creek enters Chiwaukum Creek very near the confluence with the Wenatchee River at the head of Tumwater Canyon. Highway 2 borders Skinney Creek through the Foodplain Response landtype. Redband trout appear to be the predominate salmonid in this subwatershed. Cutthroat trout have not been found in the stream to date and bull trout are considered absent. Spring chinook salmon may rear in the lower reaches but have not been documented. Steelhead have not been documented in Skinney Creek but given the presence of redband/rainbow it very

possible steelhead utilize the stream. Of special note is the existence of a significant population of redband trout in Chiwaukum Creek. The Skinney Creek fish may be part of that population.

(2) Chiwaukum subwatershed

Chiwaukum Creek headwaters are located in the Chiwaukum Mountains. The drainage flows easterly before joining the Wenatchee River at the head of Tumwater Canyon. Most of the drainage is located within the Alpine Lakes Wilderness. Bull trout inhabit the stream, cutthroat trout are found in the upper portions of the watershed and some spring chinook rear in the lower reaches. The bull trout are likely a migratory population associated with the Wenatchee River. The Chiwaukum redband were found to be interior redband trout and therefore the subwatershed is significant for redband. Proebstel and others (1996 in print) stated that it is likely that anadromous steelhead have contributed to the genetic structure of the population, thus the population probably should be considered significant for steelhead for genetic reasons.

(3) Upper Wenatchee subwatershed

The Upper Wenatchee subwatershed includes the upper Wenatchee River from the outlet of Lake Wenatchee downstream to Tumwater Canyon. This subwatershed is significant for summer chinook salmon as it is a main spawning reach. Bull trout, redband/rainbow trout and cutthroat trout are also present. Wenatchee River is a migration corridor for sockeye salmon. Some limited spring chinook salmon spawning may occur and juvenile chinook are known to rear in the upper Wenatchee. Steelhead have been observed spawning in the upper Wenatchee River. It could be argued that the upper Wenatchee subwatershed should be considered significant for steelhead and spring chinook due to it's connectivity with upstream and downstream significant subwatersheds. Home construction along the Wenatchee River and with it the potential for flood protection and loss of floodplain stream channel connectivity is a possible threat to the upper Wenatchee aquatic habitat.

(4) Tumwater Canyon subwatershed

The Tumwater Canyon subwatershed is considered significant for summer steelhead and summer chinook salmon. The Tumwater Canyon reach of the Wenatchee River provides very important rearing habitat for summer steelhead and steelhead have been observed spawning. The subwatershed is considered significant for summer chinook due to the large numbers of fish that spawn in Tumwater Canyon. Spring chinook rear in the Wenatchee River within the subwatershed, bull trout, westslope cutthroat and redband are also present. The genetic structure of the cutthroat and redband/rainbow trout are not known. A history of hatchery rainbow stocking (since halted) makes genetic introgression with native trout possible. Due to the presence of steelhead, the native redband population is likely one-in-the same with the steelhead. Redband/steelhead likely dominate westslope cutthroat in the subwatershed.

(5) Cabin-Fall subwatershed

The Cabin-Fall subwatershed includes two small drainages, Cabin and Fall Creek. The streams originate on Icicle Ridge and spill down steep slopes into Tumwater Canyon. Fall Creek literally spills over Drury Falls. Fish are limited to the very short reaches at the mouth of the streams or in the case of Cabin Creek, near the outlet of Lake Augusta. Westslope cutthroat trout are found in the lake Redband/rainbow are the only other salmonid known to inhabit the subwatershed. Although listed as unknown bull trout are likely absent unless they are found near the mouth of Cabin Creek.

(6) Middle Wenatchee subwatershed

The Tumwater MLSA includes a small portion if the Middle Wenatchee subwatershed at the mouth of Tumwater canyon, near the town of Leavenworth. All the key salmonids are present and the subwatershed is considered significant for summer chinook due to the large spawning population. Urban development along floodplains is a continued potential threat to aquatic habitat in the subwatershed

c) Wenatchee River and LSR Management Implications

The mainstem Wenatchee River and tributary subwatersheds are very important to aquatic resources within the Wenatchee Subbasin. The Chiwaukum, Upper Wenatchee, Middle Wenatchee and Tumwater are all significant for one or more species. These watersheds provide a core area around which any fish population restoration efforts in the Wenatchee Subbasin need to build upon. Conservation of aquatic resources needs to be a very high priority during planning and implementation of resource management activities. Any new management activities should be designed to pose little risk to watershed processes or aquatic habitat. There may be opportunities in the Skinney Creek subwatershed to implement landscape level forest restoration efforts. The Skinney Creek subwatershed contributes a very small portion of the flow to the Wenatchee and the low gradient reach through the Floodplain Response reach may help buffer any potential adverse effects to the mainstem Wenatchee. Potential effects to the mainstem will need to be carefully assessed though to insure a low risk of adverse impact to downstream significant habitat. Potential impacts to the redband/rainbow population should also be assessed. If the redbands are genetically "good" redbands the population would be considered significant. If the redbands are associated with a steelhead population which would be likely given connectivity with Chiwaukum Creek, the subwatershed may be significant for steelhead as well. Providing for connectivity between the Chiwaukum Creek and Skinney Creek redbands would be an important management concern.

d) Chumstick Watershed

The Chumstick watershed drains lands between Tumwater Canyon and the Entiat Mountains. Chumstick Creek flows in a southerly direction parallel to the Wenatchee River, entering the Wenatchee at the town of Leavenworth. Human actions have altered the native fish community and habitat. A road culvert blocks anadromous fish access to the Chumstick watershed and brook trout have been introduced. Floodplain development for homes, a state highway and railroad have impacted aquatic and riparian habitat. The watershed lies within the Wenatchee Swauk Sandstone Hills Subsection. Soils have high soil moisture stress with low base flows which are likely exacerbated by water withdrawal.

The Deadhorse LSR includes lands within the lower Chumstick subwatershed. Redband trout are the only native salmonid known to inhabit the Chumstick watershed. No known information exists regarding the extent to which past stocking of non-native rainbow has impacted redband population. The only other known salmonid is the introduced brook trout. Summer steelhead and possibly spring chinook salmon probably used to inhabit the Lower Chumstick. Access for the anadromous fish though is blocked by a road culvert near the mouth of Chumstick Creek. Bull trout are considered to be absent from the drainage. The presence of brook trout would be a barrier to reintroduction of bull trout, if the species was indigenous to the watershed. Pacific tree frogs, western toads and western long-toed salamanders are known to inhabit the subwatershed.

(1) Late Successional Habitat Management Implications

The present condition of aquatic and riparian resources in the Chumstick have been greatly influenced by human development. Chumstick Creek is included on the Environmental

Protection Agency 303(d) list as being water quality impaired for dissolved oxygen, pH, fecal coliform, and instream flow. Given the number of homes in the area and the risk of "catastrophic" fire due to the dense-dry forest, the Lower Chumstick may be a watershed to implement aggressive, landscape scale forest restoration, combined with watershed restoration. The Chumstick may be a watershed where potential short term impacts to aquatic resources that are designed to improve long term watershed health may be an acceptable risk. Restoration activities will need to be assessed for potential downstream impacts to aquatic/riparian habitat, private lands and domestic water use. The effectiveness of restoration efforts may be greatly increased if they can be coordinated with activities on private lands.

7. Noxious Weeds

Five noxious weed species were identified to occur within the Deadhorse LSR and Tumwater/Natapoc MLSAs. These species are discussed in priority order as identified by the noxious weed analysis module. There are no Class A presently documented from this area. Class B-designate weeds include: *Centaurea diffusa, C. maculosa, Cytisus scoparius, Linaria dalmatica,* and *Chrysanthemum leucanthemum.* These species are found along roadsides within the LSR, particularly Highway 2. Following through the noxious weed analysis module, all species are relatively widespread so the strategy is prevention of further spread. Prevention of spread should focus on areas of high recreation use such as the roadsides, particularly Highway 2, developed and dispersed sites. However, *C. scoparius* is limited to one location along FS Road #7906 and this population should be eradicated. Survey for species presence and extent should be completed in order to develop a noxious management plan for this LSR'S (refer to Harrod 1994).

8. Fire Management Plan

a) Overview

This plan is intended to provide guidance for the management of fire in the Deadhorse LSR/Natapoc MLSA/Tumwater MLSA. It will supplement the Fire Management Plan for the Late-Successional Reserve System and will be incorporated into the Fire Management Action Plan for the Wenatchee National Forest.

The Sustainability and Disturbance modules for the vegetation groups have been described in a separate portion of this chapter. The intent of this plan is to provide adequate protection of the reserve. Management practices will be initiated to provide for the protection of the late-successional associated species and associated unique habitats. These management actions are expected to include the role of fire disturbance as an important process in the reserve.

b) Wildfire Prevention Actions

The following actions are site specific for the Deadhorse LSR/Natapoc MLSA/Tumwater MLSA. They are intended to supplement the actions outlined in the Fire Prevention Plan, which is intended to be implemented on a Forest-wide basis:

1. Initiate campfire restrictions, as warranted, during periods of high fire danger.
2. Implement road restrictions and closures, as warranted, during periods of high fire danger.
3. Emphasize cooperative fire prevention activities.
4. Utilize cooperative law enforcement agreements to emphasize the inspection of spark arrestor and exhaust systems.

5. Work with Railroad to initiate fire prevention and fire risk activities, and hazard reduction actions.
6. Continue and improve fire prevention signing program on roads and trails included in, or adjacent to, the LSR/MLSA.
7. Emphasize contact with special interest groups (e.g., ORV groups, summer home groups, organization camps, local user groups, grazing permittees, and other special use permittees).
8. Emphasize fire prevention education for hunters.
9. Emphasize fire prevention and wildfire risk awareness education for the public.
10. Emphasize wildfire risk awareness education for home/landowners in urban/wildland interface areas (e.g., Coles Corner, Winton, Plain, lower Chumstick, and Leavenworth).
11. Seek opportunities to initiate hazard reduction actions around private lands (e.g., Coles Corner, Winton, Leavenworth, lower Chumstick Creek, Ponderosa Estates along the Wenatchee River between County Road 694 and US Hwy 2, and Plain).
12. Initiate hazard reduction actions around developed and dispersed recreation sites, such as:
    - Tumwater Campground
    - Swiftwater Picnic Area
    - Castle Rock
    - The Alps
    - Lake Jolanda
    - ETC... (Additional sites may be added if overlooked)
13. As a hazard reduction measure emphasize fuel wood collection in designated areas around recreation use sites.
14. Initiate hazard reduction actions around the Tumwater Botanical Area.
15. Initiate hazard reduction actions along roads.
16. Work with Utilities on hazard reduction actions under power lines. Include BPA's major transmission lines.

c) Fire Management Actions Intended to Keep Fire from Spreading into the LSR/MLSA

The following methods are proposed to protect the LSR/MLSA from fires originating outside LSR/MLSA boundaries:

1. Maintain and manage existing fuel breaks, create new fuelbreaks where appropriate.
2. Complete pre-attack planning process for the LSR/MLSA. Utilize natural fuel breaks when possible.
3. Maintain existing pre-attack facilities/agreements (e.g., water chances, helispots, fire camps, etc.): Seek opportunities for more.

d) Fire Detection

1. Staffing of Sugarloaf Lookout and Alpine Lookout, supplemented with aerial detection after lightning episodes, will provide the primary detection resource for this LSR/MLSA.
2. Aerial detection may be supplemented with emergency staffing at Boundary Butte.
3. Emphasize fire reporting procedures (e.g., with local residents, Forest users, and cooperators).

e) Wildfire Suppression

1. Spotted owl activity centers are the highest priority for protection of resources (following the protection of human life). All wildfires in the 1.8 mile buffer will be suppressed at minimum acres.
2. Pre-planned dispatch cards for initial attack will be prepared for the LSR/MLSA area.
3. The Fire Situation Analysis or the Escaped Fire Situation Analysis process will be used to guide extended attack and large fire-suppression. Utilize pre-attack plans and materials.
4. Consideration for private land, late-successional habitat, and riparian reserves will take place during the development of fire suppression strategies and the implementation of fire suppression tactics.
5. Emphasize the protection of improvements (e.g., historic/cultural sites).
6. Protect known threatened and endangered species habitat from wildfire (i.e., plant or animal).
7. Where appropriate, fire suppression actions will be implemented on an interagency basis.

f) Vegetation and Fuels Management

1. Manage for a mosaic of age classes and structural conditions across the landscape to support late-successional habitat where compatible with inherent disturbance regimes.
2. Manage to sustain dry forest types.
3. Manage for mesic sites with high density, multi-story refugia.
4. Strategic fuel manipulation to reduce the size and intensity of fires within, and adjacent to, the LSR/MLSA boundaries (e.g., pruning, thinning, prescribed fire and fuel breaks). Provide a change in the continuity/arrangement of, at risk, vegetation/fuels. Emphasis to utilize existing fuel treatment areas, natural openings, roads, ridgetops, etc. Priority areas: North Fork Derby Canyon, Eagle Creek, Van Creek, and upper Beaver Creek.
5. Emphasize roadside fuel modification and fuel wood collection (e.g., roads in the Chumstick and Tumwater areas).
6. Suggested management tools to sustain, enhance, or produce the conditions for late-successional habitat and provide for wildfire hazard reduction may include: pruning, commercial and pre-commercial thinning, wood gathering, mechanical treatments, and prescribed fire.
7. Prevent the spread and/or introduction of noxious weeds.

g) Prescribed Fire Opportunities

1. Recognize the use of prescribed fire as a management tool in this LSR/MLSA and in areas adjacent to this LSR/MLSA.
2. Priority outcomes throughout the LSR/MLSA are to sustain, enhance, or produce the conditions for late-successional habitat and provide for wildfire hazard reduction.
3. Projects should be of scale/location to enhance landscape-level diversity tied to inherent disturbance regimes.
4. Projects should attempt to minimize the risk of future catastrophic wildfires (those outside the range of inherent disturbance regimes with respect to size and/or severity).

h) Summary

Fire prevention, fire detection, wildfire suppression, vegetation and fuels management, and prescribed fire are all appropriate, integral elements of the overall management of this LSR/MLSA.

D. Restoration Opportunities and Potential Project Summary

Table X-20, Restoration Opportunities and Potential Projects, Deadhorse LSR and Tumwater and Natapoc MLSAs.

Analysis Module	Restoration Opportunity	Potential Projects	Schedule[1]
Forest-Wide Sustainability	1) Reduce fuel loading and stocking levels in dense successionally advanced dry forest stands where they exist between the Deadhorse, Natapoc and Tumwater LSR/MLSAs and Chiwawa and Eagle LSRs.	1) Use commercial thinning, pruning, fuelwood collection and prescribed fire as described in the disturbance module treatment key. Favor the development of seral species such as ponderosa pine and western larch. Locate and prescribe treatments to make landscape level changes in fire susceptibility.	A
	2) Encourage private landowners in the Chumstick Valley to take similar density management as described in 1 above	2) See 1 above.	B
	3) Improve or maintain existing fuelbreaks (Chumstick Valley road and BPA power-line)	3) Piling of down fuels, firewood gathering, pruning, shaded fuel breaks, and encouragement of less flammable deciduous vegetation.	A
	4) Reduce fuel loading in young stands.	4) Pre-commercial thinning.	C
Forest-Wide	Not Applicable. (This LSR is not one of the 3 LSRs on the	Not Applicable.	

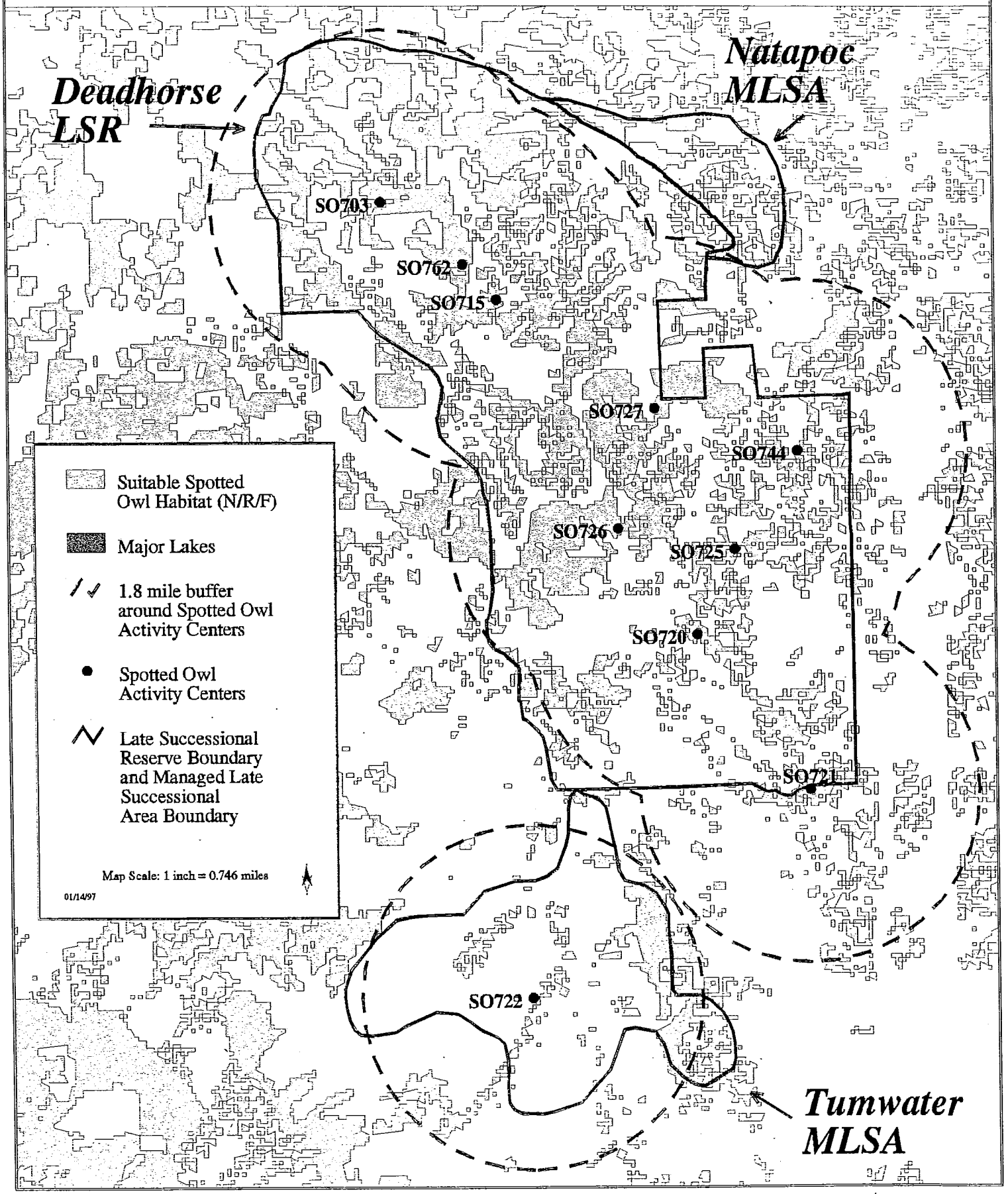
Analysis Module	Restoration Opportunity	Potential Projects	Schedule[1]
Spotted owl	forest designated as a source population area.)		
Forest-Wide Connectivity	1) Promote the development of fire climax stands within the dry forest vegetation group.	1) Thin from below favoring ponderosa pine. Retain healthy large diameter pine if present.	A
Unique Habitats & Species	1) Reduce road densities in riparian reserves.	1) Close or relocate roads as opportunities are identified in Access and Travel Management Planning. Focus on.	A
	2) Promote the development of fire climax stands within the dry forest vegetation group.	2) Thin from below favoring ponderosa pine. Retain healthy large diameter pine if present.	A
	3) Increase security habitat in Natapoc MLSA.	3) Close roads as opportunities are identified in Access and Travel Management Planning. Focus on.	B
Connectivity Within the LSR	1) Promote the development of fire climax stands within the dry forest vegetation group.	1) Thin from below favoring ponderosa pine. Use prescribed fire where current fuel loading permit the attainment of objectives.	A
	2) Improve the function of Riparian Reserves as connectivity corridors.	2) Close roads and re-vegetate disturbed areas within riparian Reserves as opportunities are identified through Access and Travel Management Planning.	B
Disturbance	1) Reduce the risk of habitat loss to wildfire by reducing stand density, altering species composition and reducing vertical and horizontal fuel continuity in dry forest types.	1) Use commercial thinning, pruning, fuelwood collection and prescribed fire as described in disturbance module treatment key. Favor the development of seral species such as ponderosa pine. Priorities should be 1) Dispersal habitat. 2) NRF habitat within the LSR/MLSA but outside of owl circles, 3) NRF habitat within the owl circle on above threshold acres (owl 703), 4) See item #2 under spotted owl for treatment of NRF habitat on threshold acres..	A

Analysis Module	Restoration Opportunity	Potential Projects	Schedule[1]
	2) Maintain existing fire climax stands within the dry forest vegetation group.	2) Prescribed fire.	C
Spotted Owl	1) See Appendix 39, "Northern Spotted Owl Nest Site Protection Within LSRs and MLSAs"		A
	2) Improve sustainability of dense dry forest (vegetation Type 12) within 0.7 to 1.8 mile home range area on threshold acres. Treatment should maintain suitability of habitat for nesting, roosting and foraging. (see spotted owl desired conditions)	2) Utilize commercial thinning, pruning and fuelwood collection.	A
	3) Improve sustainability of dense dispersal habitat (codes 13 and 21)	3) Utilize commercial thinning, pruning and fuelwood collection.	A
	4) Obtain information on spotted owl locations.	4) Survey areas to 1994 spotted owl protocol.	B
	5) Accelerate the development of suitable spotted owl habitat. Focus on wet dispersal habitat owl #762.	5) Utilize Silvicultural activities that accelerate the development of multi-layered stands. Focus on single layered pole size stands in moist grand fir and wet forest groups. This option appears limited to owl #762.	C
Aquatic	1) See late successional habitat implications in Aquatic section.	1) Coordinate projects with Wenatchee Mainstem Watershed Assessment planned for completion in FY 97.	B
Noxious Weed	1) Limit the extent and spread of centauria diffusia, C. maculosa, Cytisus scoparius, and Linaria dalmatica.	1) Focus on prevention measures to limit extent and spread.	A
	2) Increase knowledge regarding noxious weed presence in the LSR/MLSAs.	2) Survey LSR/MLSAs for presence of noxious weeds.	C
Fire Plan	1) Protect LS values from loss due to wildfire	1) See fire plan for specific actions	

[1] Implementation Schedule; (A) = within 1 year; (B) = within 3 years; (C) = within 5 years

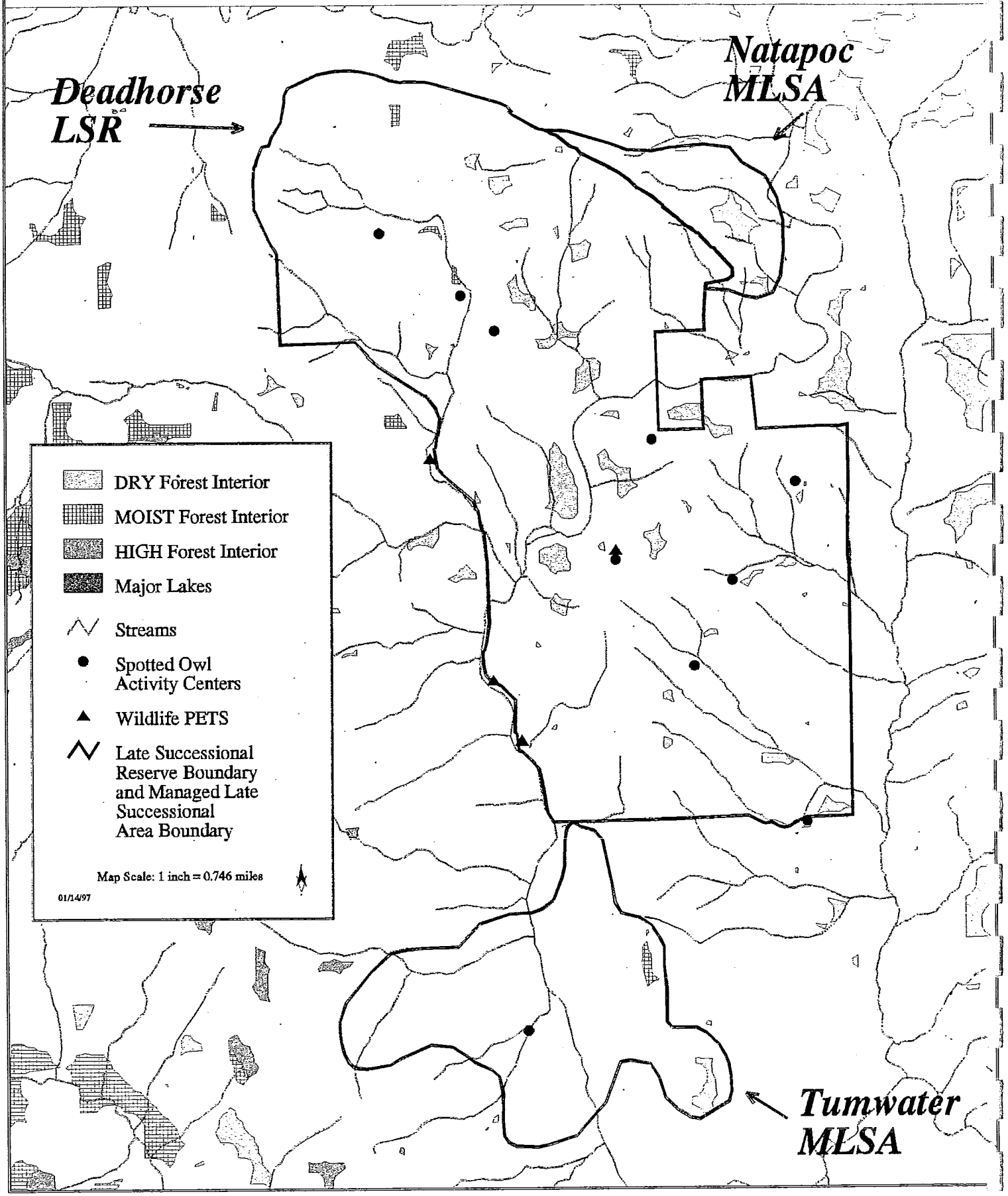
Deadhorse Late Successional Reserve and Tumwater and Natapoc Managed Late Successional Areas

SUITABLE SPOTTED OWL HABITAT



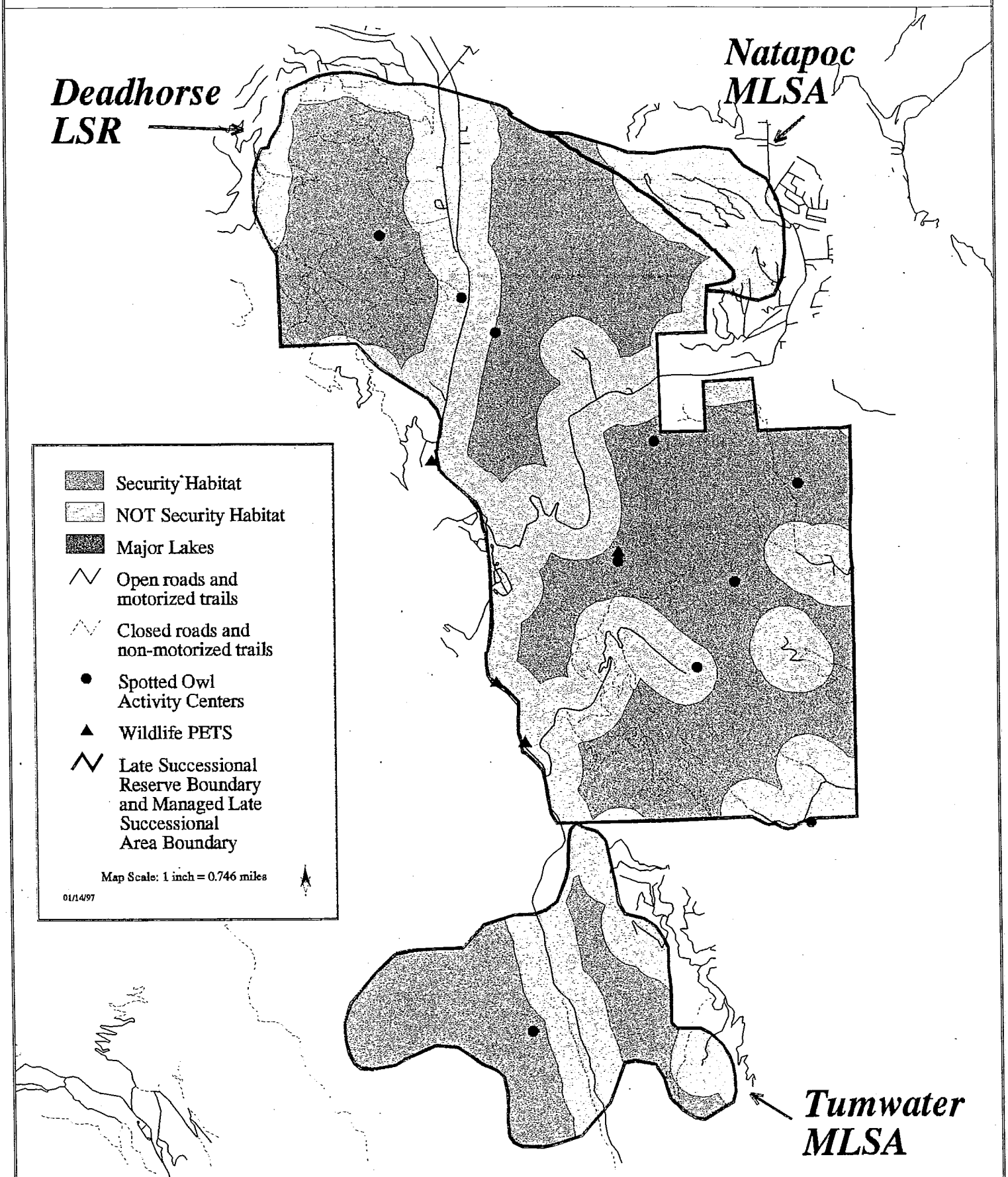
Deadhorse Late Successional Reserve and Tumwater and Natapoc Managed Late Successional Areas

FOREST INTERIOR



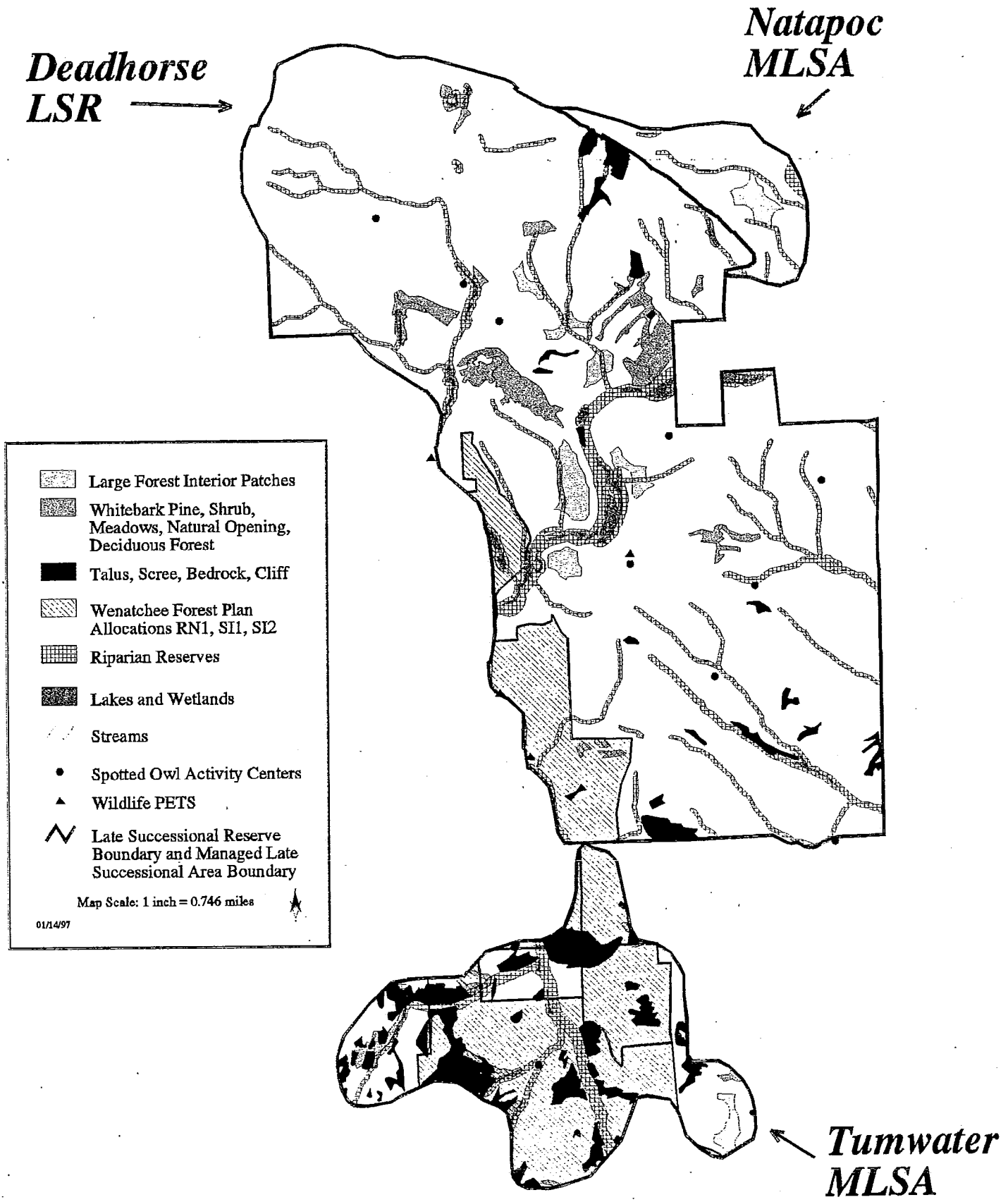
Deadhorse Late Successional Reserve and Tumwater and Natapoc Managed Late Successional Areas

SECURITY HABITAT



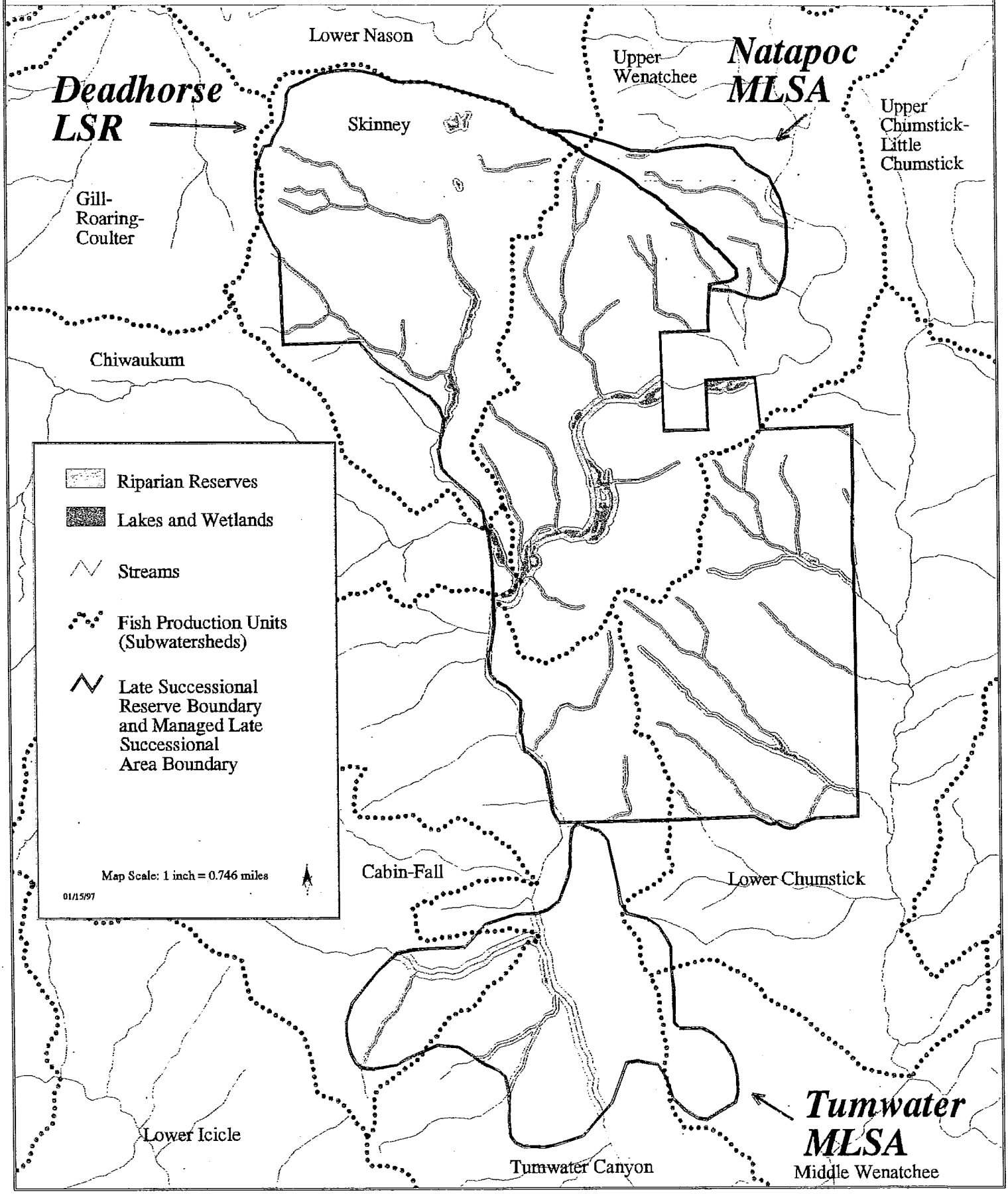
Deadhorse Late Successional Reserve and Tumwater and Natapoc Managed Late Successional Areas

UNIQUE HABITATS



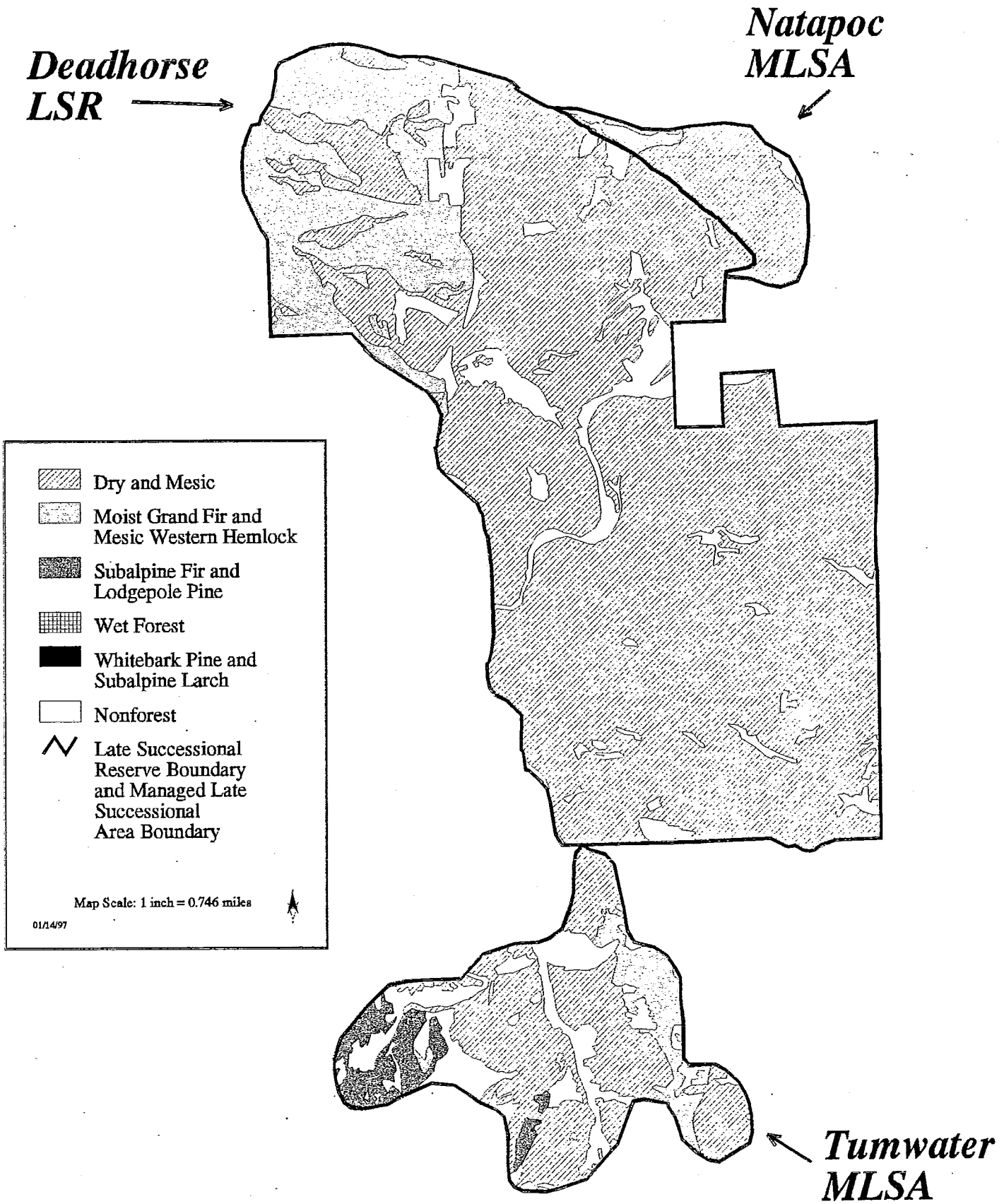
Deadhorse Late Successional Reserve and Tumwater and Natapoc Managed Late Successional Areas

FISH PRODUCTION UNITS (SUBWATERSHEDS)



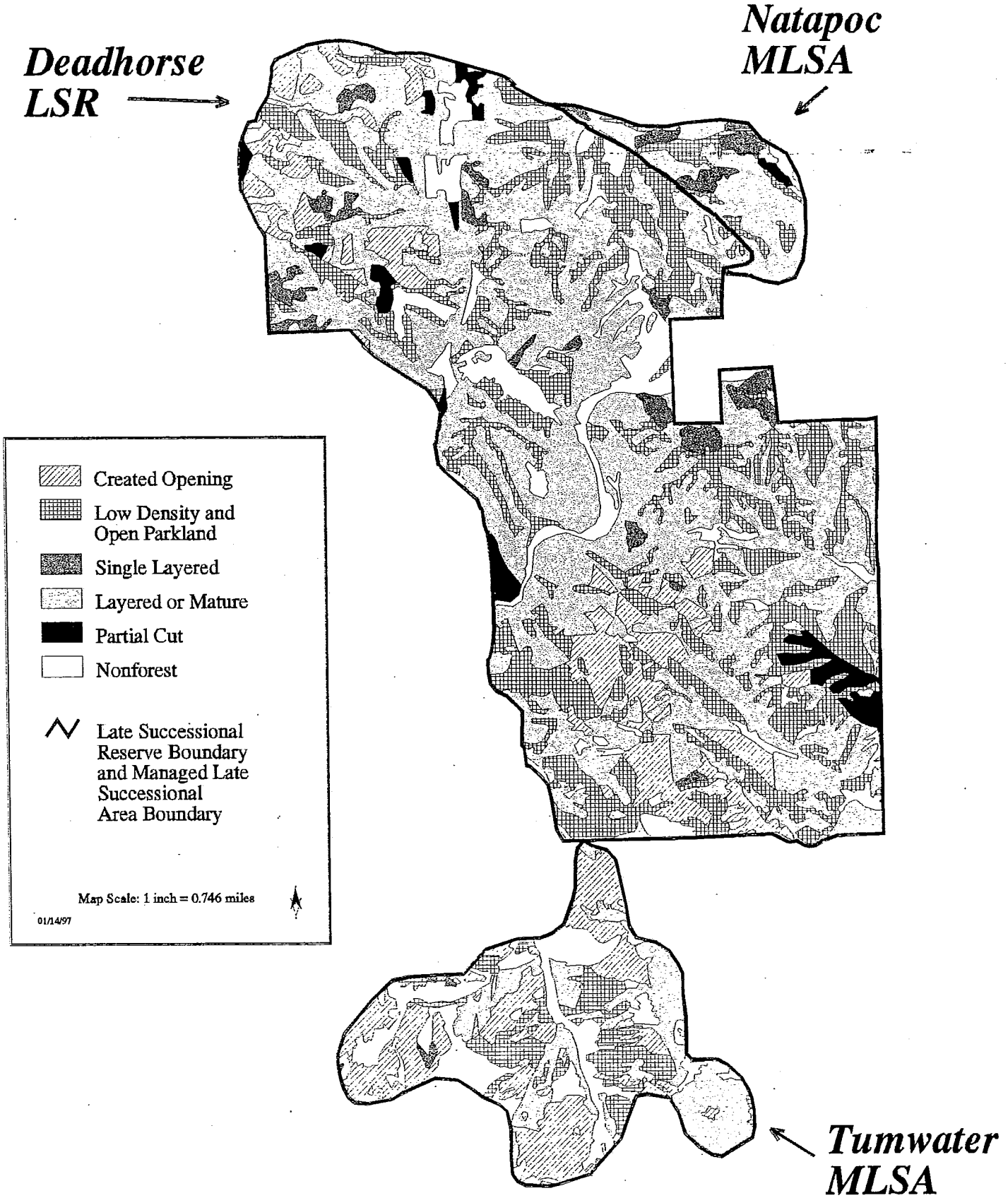
Deadhorse Late Successional Reserve and Tumwater and Natapoc Managed Late Successional Areas

VEGETATION SERIES



Deadhorse Late Successional Reserve and Tumwater and Natapoc Managed Late Successional Areas

VEGETATION STRUCTURE

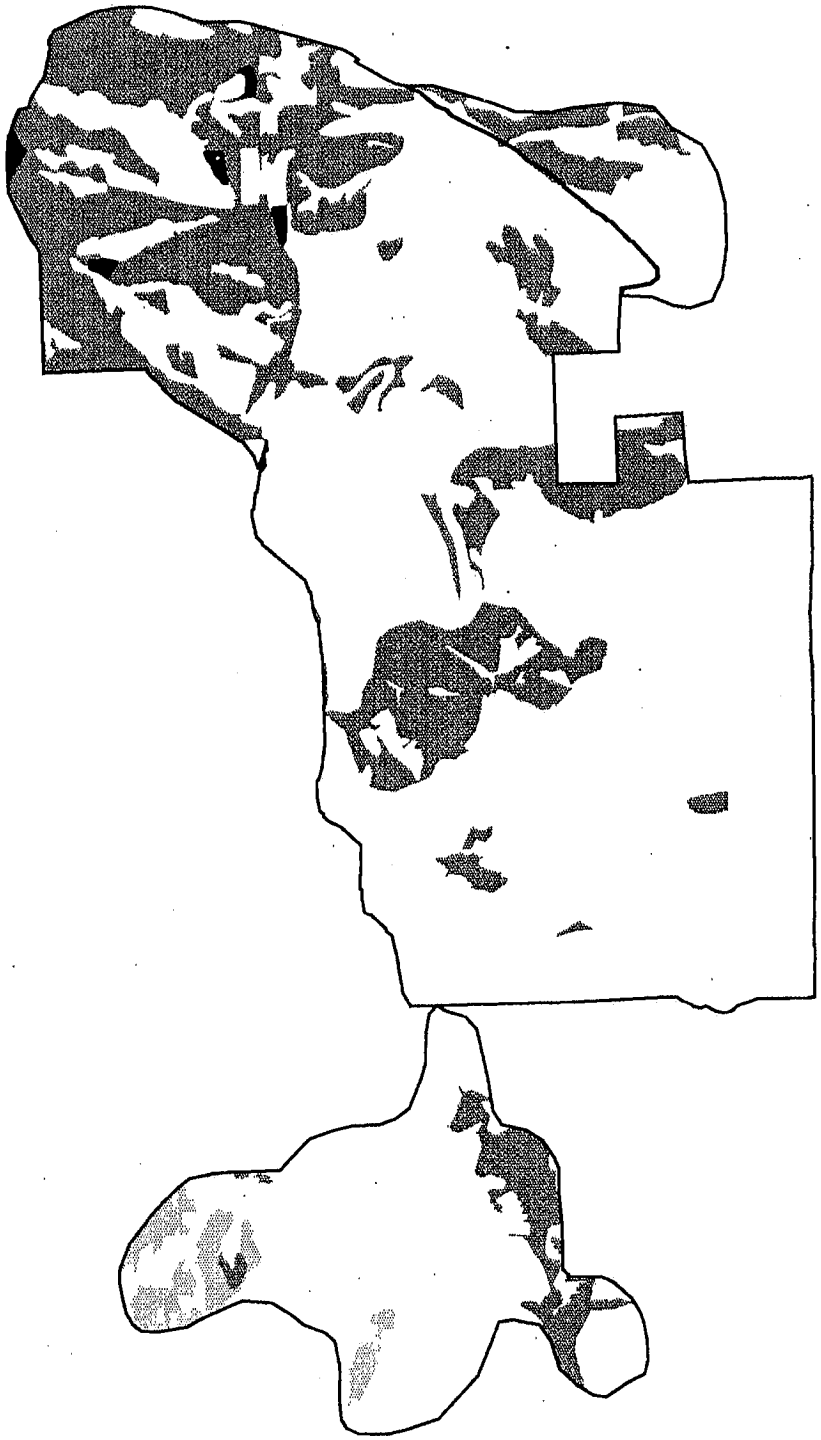


Deadhorse/Natapoc /Tumwater Disturbance Matrix

Total Risk
- High Risk
- Low Risk
- Moderate Risk
- No Risk

1 0 1 2 3 Miles

N

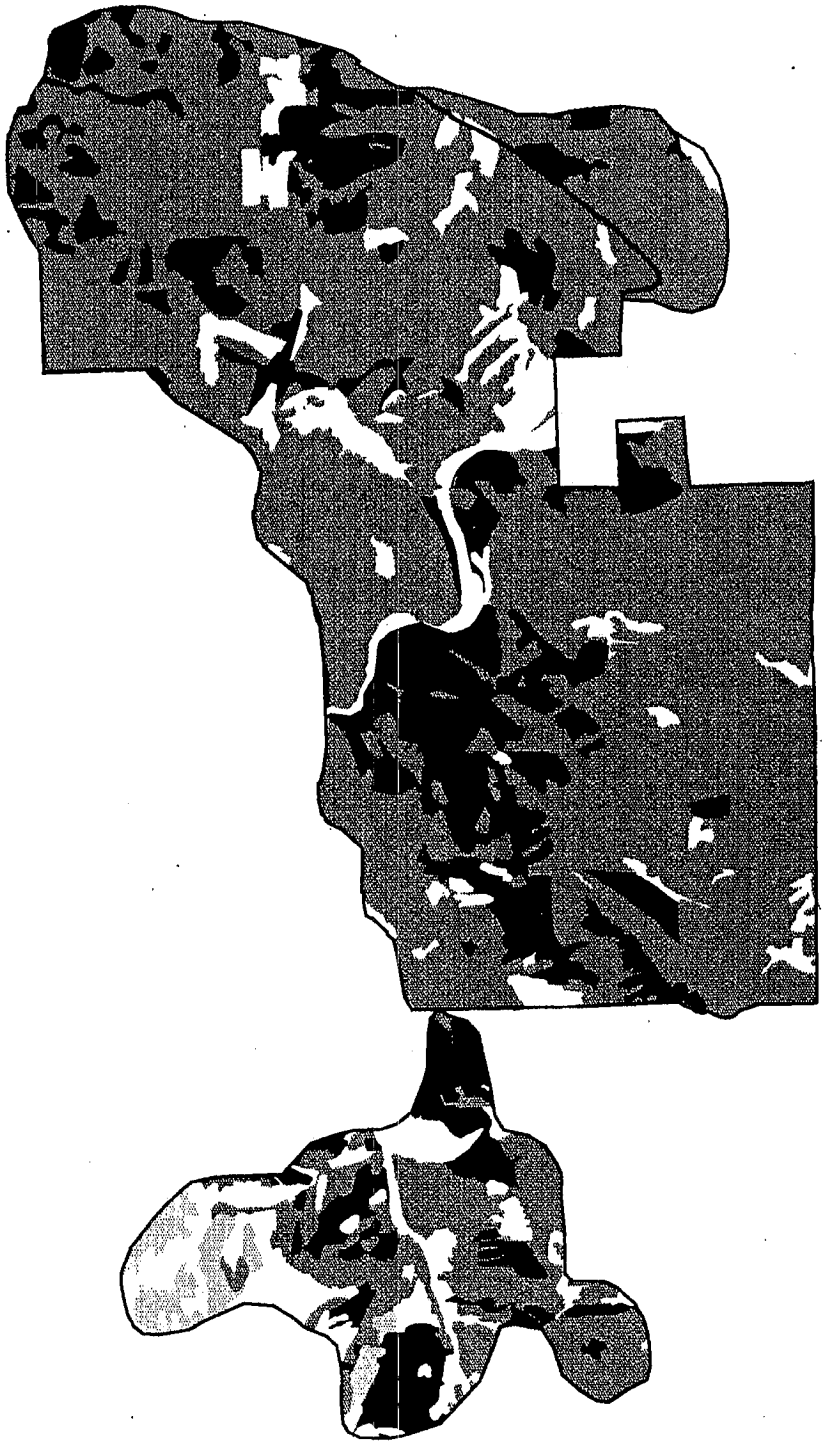


Deadhorse/Natapoc /Tumwater Disturbance Matrix

Fir Engraver
- High Risk
- Low Risk
- Moderate Risk
- No Risk

1 0 1 2 3 Miles

N



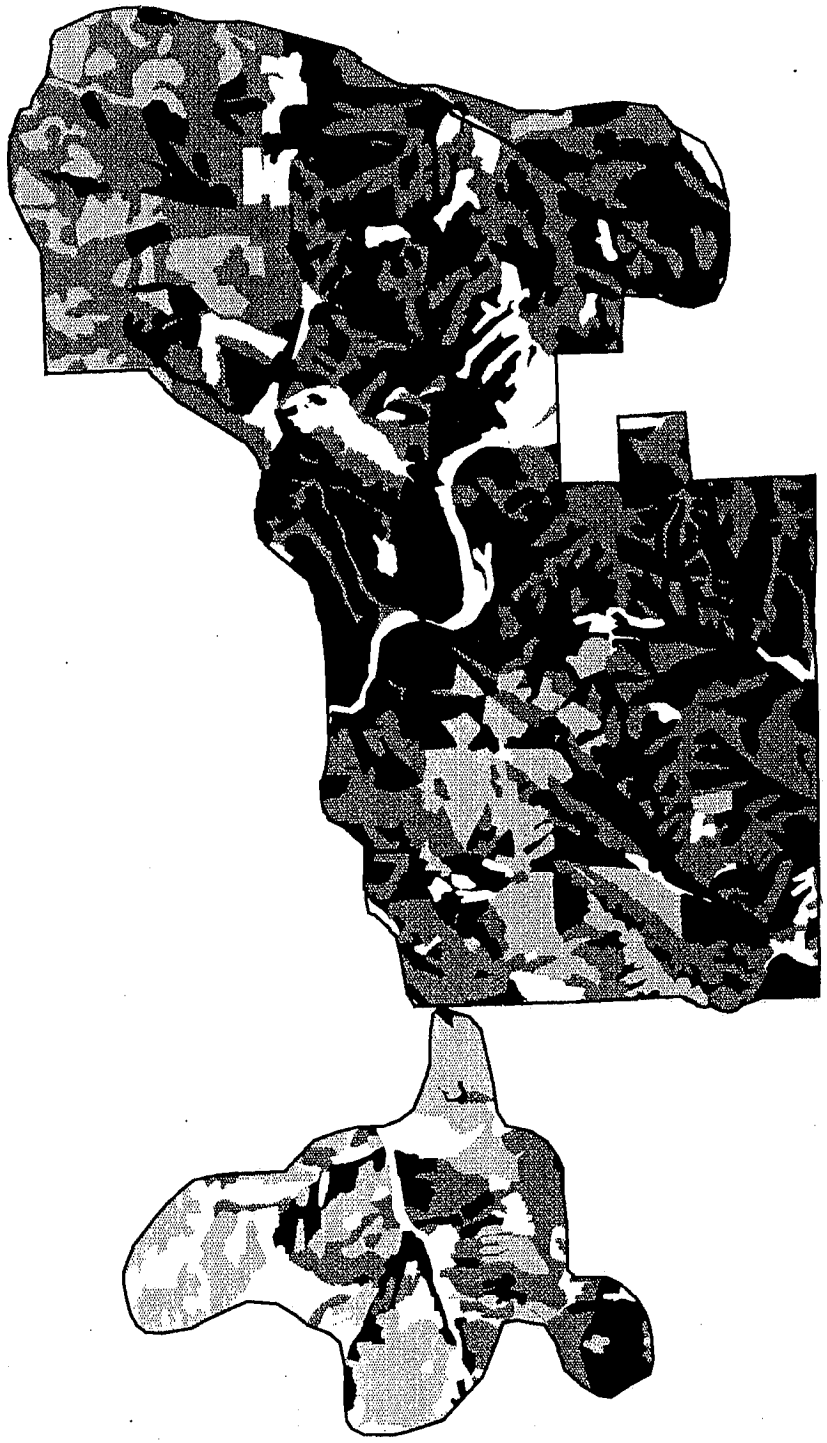
Deadhorse/Natapoc /Tumwater Disturbance Matrix

DHB

- High Risk
- Low Risk
- Moderate Risk
- No Risk

1 0 1 2 3 Miles

N



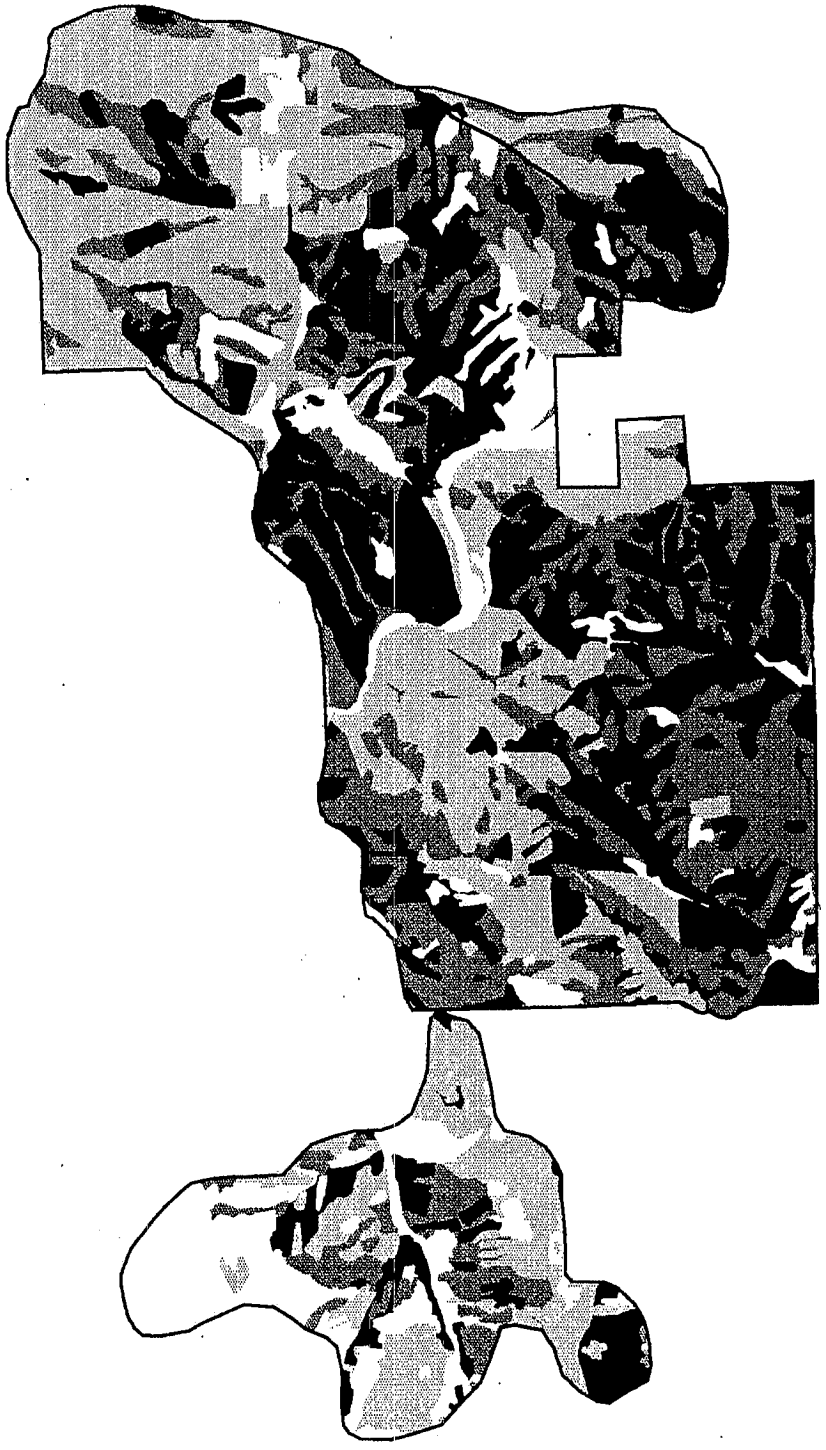
Deadhorse/Natapoc /Tumwater Disturbance Matrix

WSB

- High Risk
- Low Risk
- Moderate Risk
- No Risk

1 0 1 2 3 Miles

N



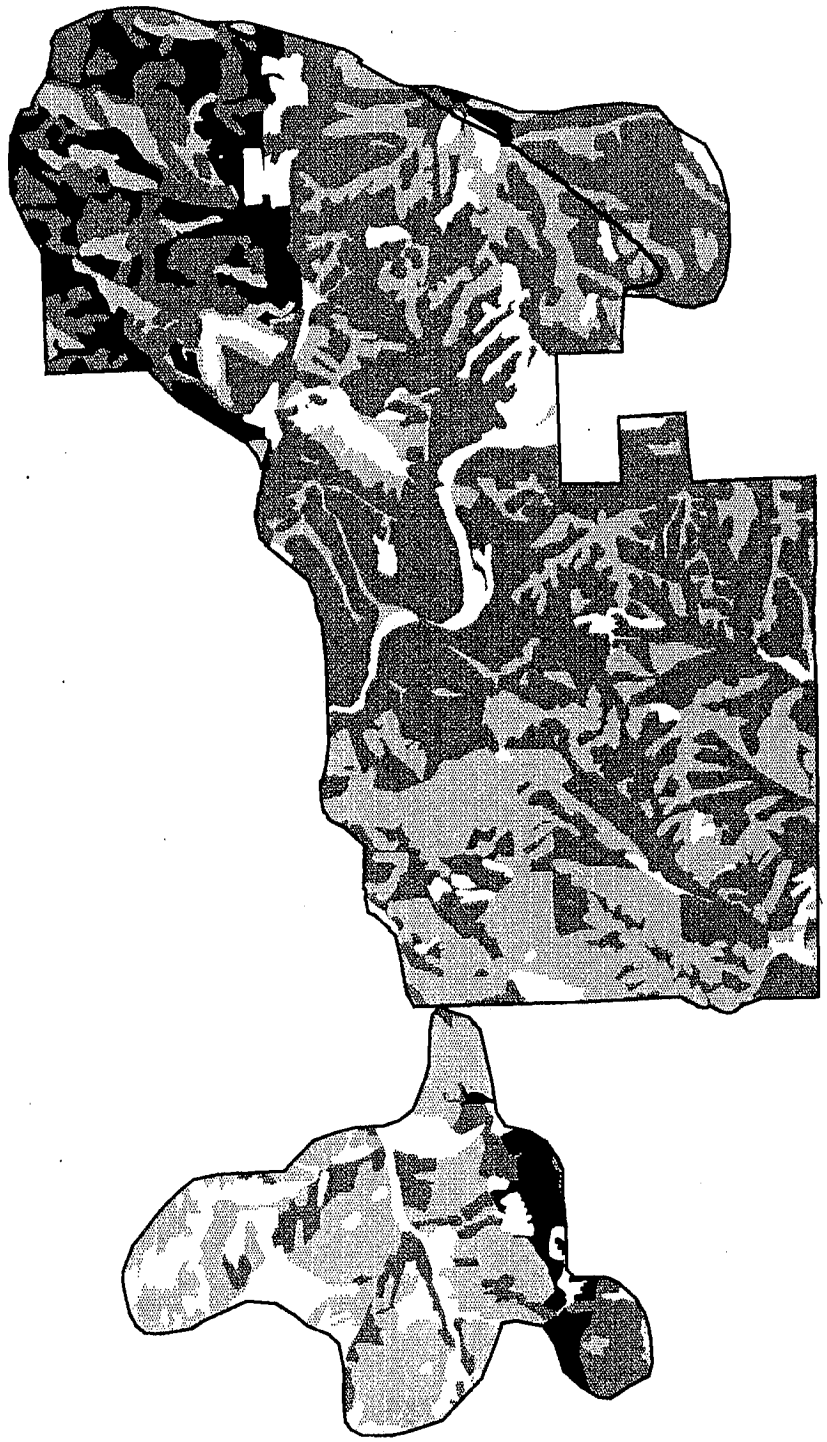
Deadhorse/Natapoc /Tumwater Disturbance Matrix

WPBR

- High Risk
- Low Risk
- Moderate Risk
- No Risk

1 0 1 2 3 Miles

N

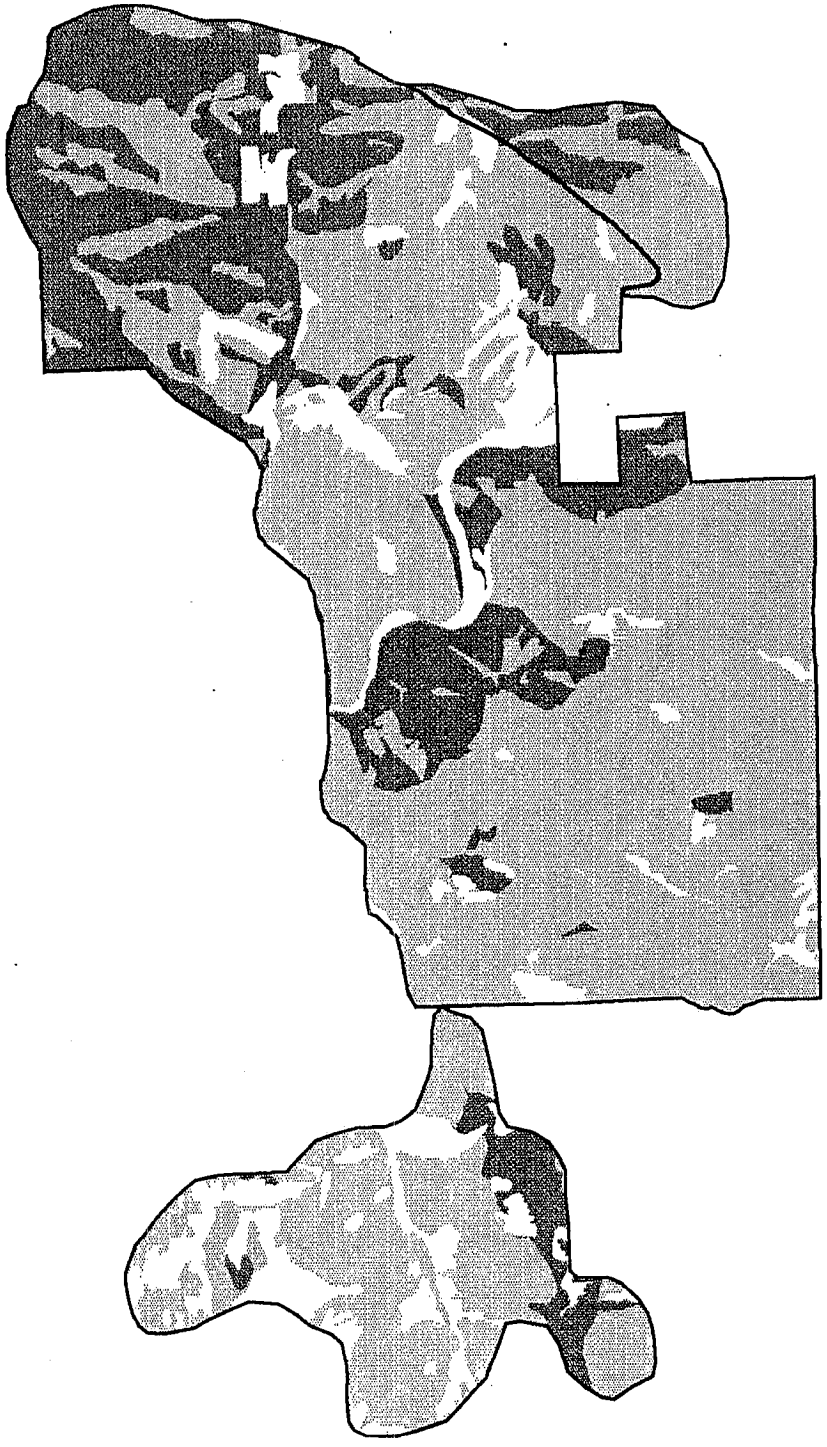


Deadhorse/Natapoc /Tumwater Disturbance Matrix

PHWE Root Decay
- High Risk
- Low Risk
- Moderate Risk
- No Risk

1 0 1 2 3 Miles

N



Deadhorse/Natapoc /Tumwater Disturbance Matrix

Root Disease HEAN

- High Risk
- Low Risk
- Moderate Risk
- No Risk

1 0 1 2 3 Miles

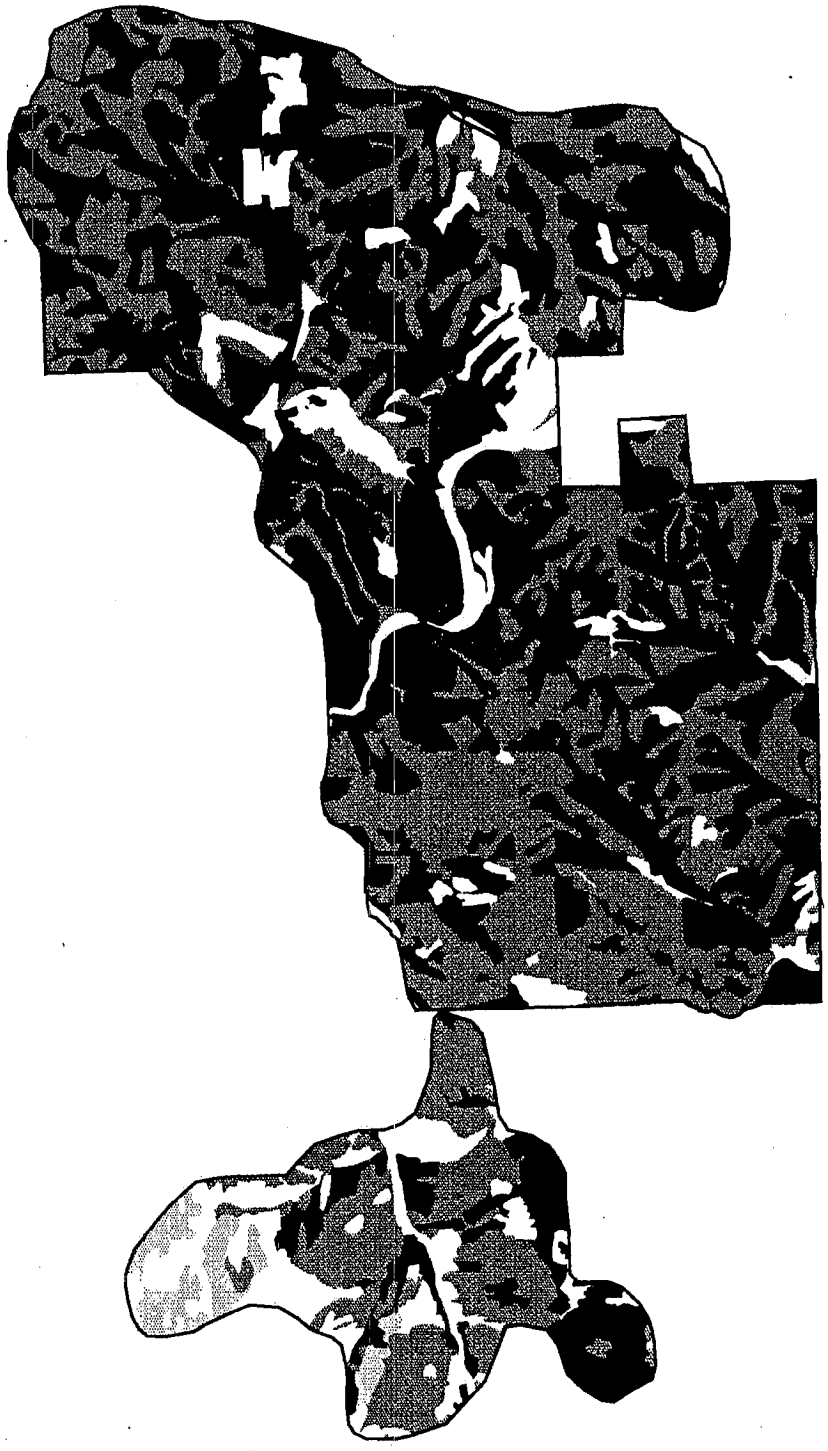
N

Deadhorse/Natapoc /Tumwater Disturbance Matrix

Root Disease AROS
- High Risk
- Low Risk
- Moderate Risk
- No Risk

1 0 1 2 3 Miles

N



Deadhorse/Natapoc /Tumwater Disturbance Matrix

Dwarf Mistletoe DF
- High Risk
- Low Risk
- Moderate Risk
- No Risk

1 0 1 2 3 Miles

N

Deadhorse/Natapoc /Tumwater Disturbance Matrix

Fire

- High Risk
- Low Risk
- Moderate Risk
- No Risk

1 0 1 2 3 Miles

N